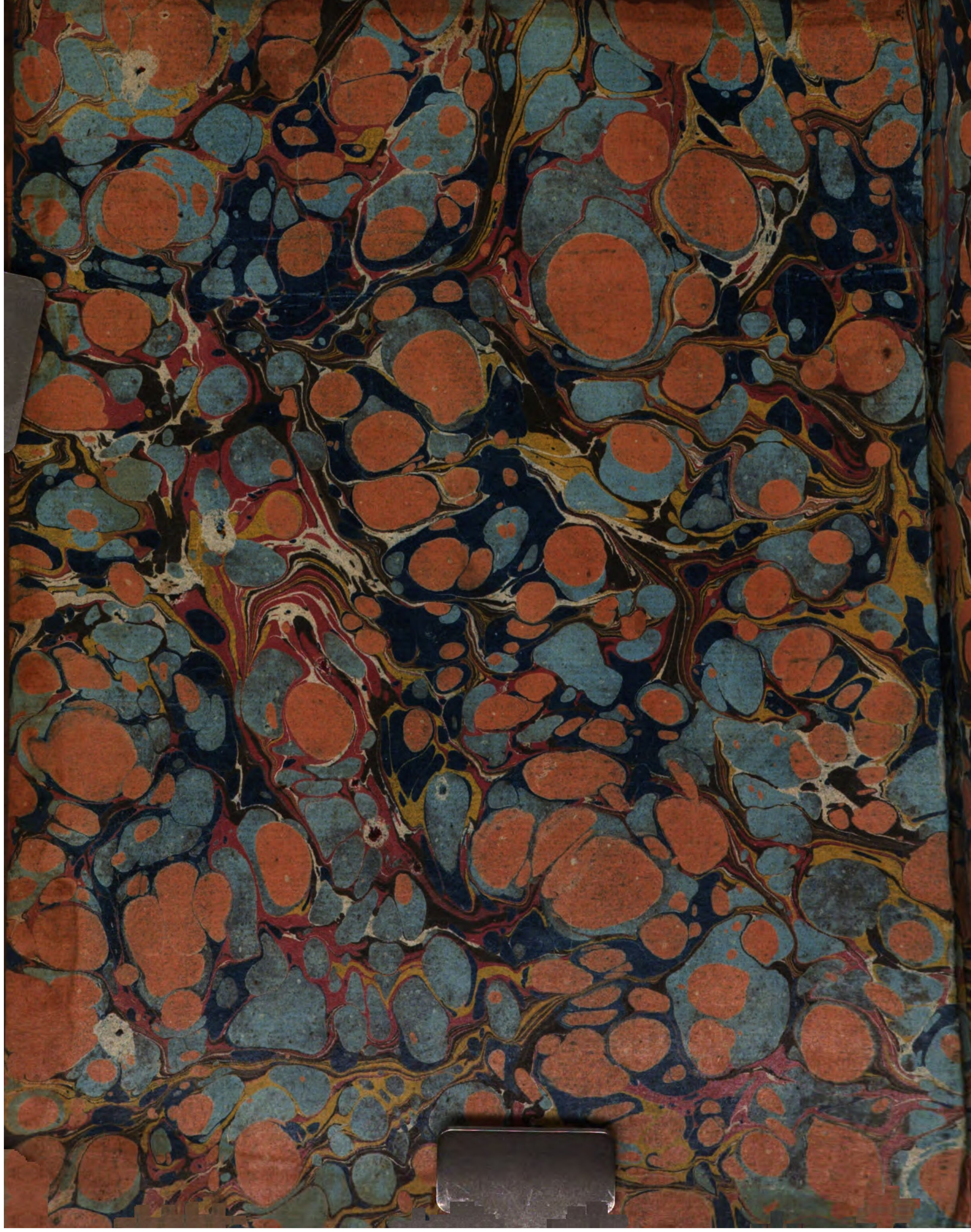








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MANAGEMENT OF HEEB.

WHEREIN IS CONTAINED

THE NATURAL HISTORY OF THE HEEB.

With the various Methods of Cultivating the same, and the several Sorts of Trees and Plants which are proper for it.

By JOHN HEEB.

The Natural History of the HEEB, and the several Sorts of Trees and Plants which are proper for it.

Printed with COLOUR-PLATES.

By THOMAS WILKINSON.

L O N D O N.

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T R E A T I S E
ON THE
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WHEREIN IS CONTAINED

The N A T U R A L H I S T O R Y of those Insects ;

With the various M E T H O D S of cultivating them, both A N T I E N T and M O D E R N ,
and the improved T R E A T M E N T of them.

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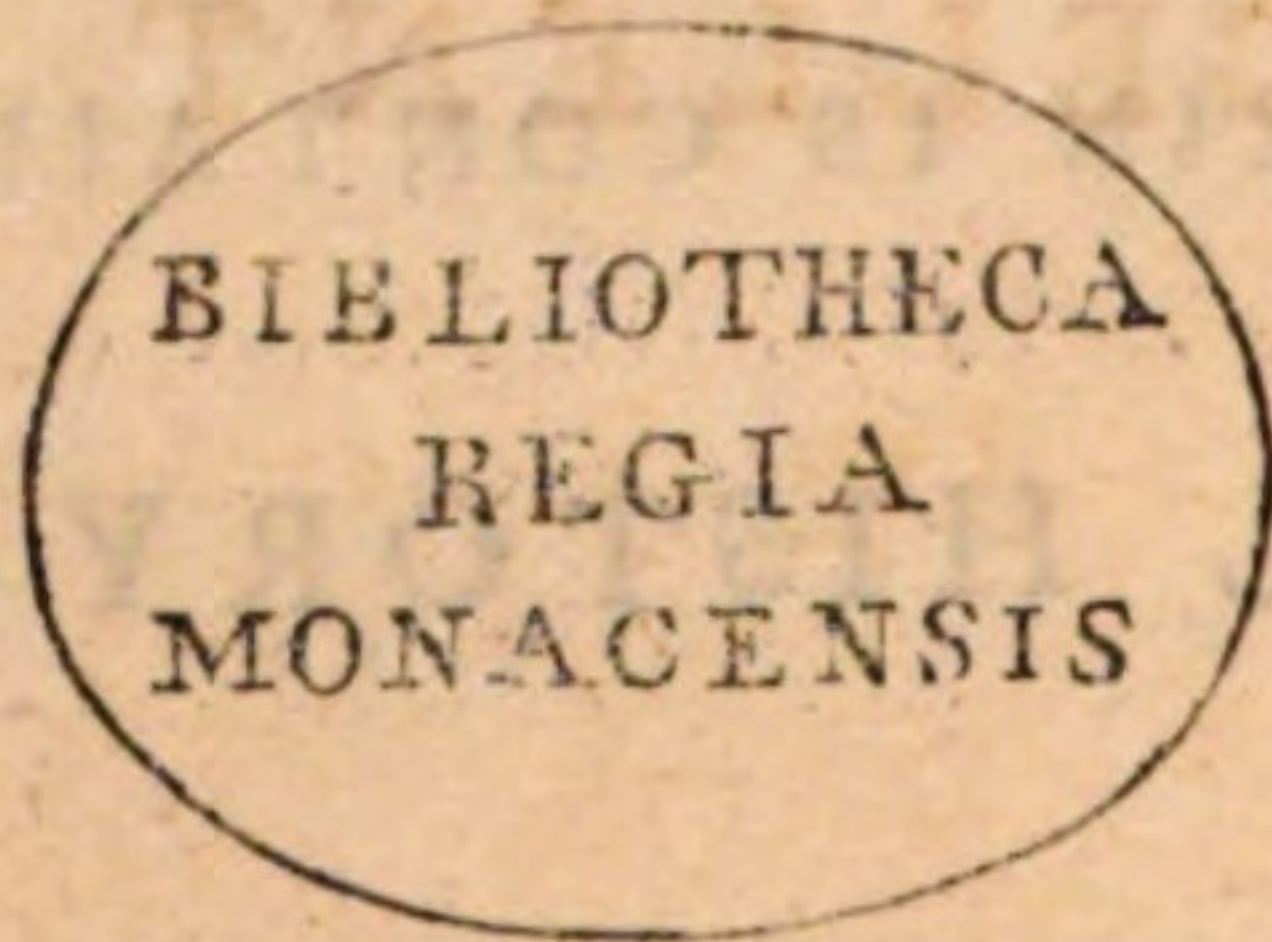
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destroying them.

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By T H O M A S W I L D M A N .

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TO THE
QUEEN'S
MOST EXCELLENT MAJESTY.

M A D A M,

THE following sheets, which treat of bees, are inscribed to your Majesty with the greatest humility. They contain the internal constitution of nations infinite in their numbers, where nature has settled the wisest regulations of policy and subordination, whose supreme magistrate is a Queen, who is in every respect the mother of her people, and whose gratitude, homage and affection to her is equally sincere and lasting.

They cannot therefore be more properly placed than under the protection of your Majesty, whose amiable character and great virtues shed a happy influence over all the subjects of these kingdoms.

If the author pretends to any merit that might intitle him to so great an honour, it is in having discovered a method of preserving the lives of those innocent and useful insects, whose labour and industry has been hitherto

DEDICATION.

the occasion of their death. And he therefore hopes he has contributed to put an end to the cruelty and ingratitude, which have attended the methods of taking their wax and honey.

I have the honour of being with the highest sense of duty, respect and gratitude,

Your Majesty's most obliged,

most devoted, and most humble servant,

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P R E F A C E.

BEFORE sugar became so plentiful as it has been since the Europeans have got possession of the West India islands, honey was much more valuable than it is at present, being then the chief ingredient in general use for sweetening every article of food. As the value of honey has however lessened, luxury has increased the price of wax, which is now become the greatest supply of light in all polite assemblies ; as well as in the Romish churches, in which wax-candles are kept constantly burning. By this means, wax is become a considerable article of commerce, and as such, is now become the chief inducement for the care bestowed on bees, especially in the warmer climates : for there wines supply the place of the mead made in northern countries. But the Africans and Asiatics, being forbid the use of wine, cultivate very few vines : nor do they raise sugar canes in great quantities : honey consequently continues of great use to them ; and from this cause, it probably is, that Africa affords the great supply of wax to the western parts of Europe, as Asia and Greece do to the eastern.

It will appear, in the course of this work, that on account of the wax, the French have attended greatly to the culture of bees ; not only in the curious accounts given of their propagation and œconomy by the learned, but also in regard to the most profitable method of cultivating them. As an instance of this, I shall here do justice to a gentleman whose name does not occur in the body of this work, because he has not given particular directions for the management of bees : but he has done what I wish many landed gentlemen in this country would imitate.

We are informed in the *Ecole d'Agriculture*, page 35. that M. Feydan de Brou, intendant of Rouen, by an ordonnance of the fifteenth of November 1757, has, *for the relief of the poor, and to encourage them in their labours, granted to the inhabitants of the country* (by which I suppose he means the most indigent, as well as the more substantial farmers) *who keep hives of bees, a diminution of the capitation tax, proportioned to the number of hives they have each year.*

The same author observes, page 92, that the culture of bees is a branch of rural œconomy, the more valuable, as it is within the reach of the poorest cottager. It requires not plowing, manure, cattle, nor rich meadows. The whole that is wanted is an attendance which may be given by the meanest, and that but for a short time. In this respect, it is really reaping without sowing. As an article of great importance, the author recommends it as worthy the particular attention of the schools of agriculture, which he proposes should be established in different districts of France.

In the course of the following work, every thing relating to these useful insects is treated of with the utmost care, beginning in the first book with an abstract of the natural history of bees, written by Messrs. Maraldi and de Réaumur, and brought within as narrow a compass as the variety of curious matter discovered by these authors would admit of. It cannot be expected that a minute detail of what fills volumes can be contained in a few sheets; yet the author hopes that on examination, very few essential circumstances will be found to have escaped him. The chief intention of giving this extract is to point out to gentlemen who have leisure and genius, the objects on which their inquiries should be founded. These researches will be greatly forwarded by the ease with which the bees may be come at, both on account of the better construction of my boxes, and of the command which experience may now give to every person over bees. This latter advantage is what strikes

spectators at first sight; yet I dare promise, that on an attentive perusal of the following sheets, the judicious reader will agree with me in opinion, that the total alteration which I propose to make in the management of bees, will be found to be the most essentially useful part of the work.

In the first chapter of the second book, I point out the situations most proper for bees, and also describe my hives and boxes with all possible accuracy, in order that, as they are constructed with views greatly different from those of former hives and boxes, the owner may be perfectly acquainted with these differences. And to render every part of my management of bees as clear and concise as I can, I take in the succeeding chapters every step as they follow in the order of the seasons, commencing with the spring, when the round of their operations may be said to begin.

As a full account of the generation of bees, which is their great object during the spring, has been given in the first book, I proceed in the second chapter to treat of their swarming, the natural consequence of the increase of their numbers. I give an account not only of what is necessary to be done when the swarms come off in the natural way, but I also instruct the owners of bees how to cause them to swarm, when, by the want of a queen, or for some other reason, they are prevented from swarming. The reader will find here some directions never hinted at, or practised by any former writer.

In the third chapter, I give a succinct detail of the management of bees in my hives and boxes, in which, I flatter myself, their superiority in several respects over those in common use, will evidently appear. Their construction and size are particularly accommodated to the purposes of frequently taking wax and honey, and yet being well assured of constantly leaving the bees such a stock of honey as shall afford them sufficient provision, in case of an unfavourable season.

Shifting the abodes of bees, treated of in the fourth chapter, is a circumstance very little attended to in this kingdom, which yet might certainly be of considerable advantage. The antients were well acquainted with the utility of this measure, and practised it with great success. It has been lately introduced into France: and I hope the several instances given of the good effects of this practice will prompt our countrymen to attend to this very easy method of encouraging the industry of the bees, and which is at the same time so profitable.

But the superiority of my method of managing bees, both in my hives and boxes, will more particularly appear in the fifth chapter. There, the reader will see, with what ease the wax and honey are taken, even at pleasure, with very little annoyance to the bees. Where the old hives are still made use of, more skill is necessary in causing the bees to quit their hive: and I have there laid down the plainest directions for executing this so seemingly arduous a task. In these directions is contained the truly useful part of my command over bees. But I find that the public expect from me the whole of my secret influence over them. In compliance therefore to their wishes, I add an account of all I do in that way; but I own it is with reluctance; being well assured that many hives of bees will fall a sacrifice to unskilful and unexperienced hands, in the repetition of my experiments.

The sixth chapter contains directions for separating the wax and honey.

Having thus given an account of the management of bees in the garden, or apiary, during the season of collecting honey, I point out, in the seventh chapter, the manner of discovering bees in the woods or forests: and give ample directions for taking them out of trees or walls,

walls, with their combs; and for putting them into hives, reserving a sufficiency of honey for their winter provision.

The bees being now delivered from their annual massacre, by their most inhuman enemy, man, I proceed, in the eighth chapter, to enumerate their other enemies, particularly the moth. My method of managing bees will be the most effectual preservative from this destroyer, who has baffled the ingenuity of ages, in their attempts to get rid of him: for the combs in my hives or boxes may be changed before the moths can have made themselves a secure settlement. I here also guard against an enemy scarce mentioned by authors, viz. millepedes, or wood-lice, which I have sometimes found to commit so great havock in hives, that the bees have been forced to quit them.

What other inconveniencies happen to bees, is the subject of the ninth chapter. Here Madam Vicat is signalized for her very uncommon attention to bees, and for her judgment and ready invention in applying such helps as their various disorders would admit of. No person deserves greater commendation in this article than is due to her. I am very happy in having such ingenious fellow-labourers, as this lady, and the Count de la Bourdonnaye, in our attempts to save the lives of these industrious insects; and not a little proud of the similarity of our views, and of the means we make use of.

The feeding of bees, and the care of them during the winter, become the subject of the tenth chapter; and I close this book, in the eleventh chapter, with directions for making mead. When an improved method of managing bees is become general, the quantity of honey collected will, I hope, be such as shall become the means of making considerable quantities of this excellent wholesome liquor. It will still better deserve these epithets, when a more established practice has taught us the best manner, and the proper degree of fermentation; and a due age is added. But fermentation not being the proper subject of this work, a detail of every step necessary in

the making of mead, would run into too great a length. The composition and strength of it may indeed be varied according to the fancy of each person who makes it: and for this reason, an out-line only is given.

In the third book, the natural history of Wasps and Hornets is extracted from the same *Memoirs* from whence that of the bees was taken, and directions are given for destroying them. The means of accomplishing this end are very simple, and arise from the account given of these insects. Their enmity to bees, as well as the hurt done by them to men, and to all domestick animals, point out the destroying them as an object worthy of our attention.

In order to explain some parts of the natural history of bees and wasps, plates are given representing the bees, and the combs of both bees and wasps: and a third plate, giving views of my boxes and hives, and also of an instrument very useful for feeding bees.

It is just that I should here acknowledge my obligations to John Mills, Esq; F. R. S. for his ready permission of making use of his accurate and judicious collection of what has been written on this subject in foreign languages.

N. B. I forgot when treating of bees in the winter, to mention, that in the month of October, the panes of glass should be all taken out of my boxes, and pieces of soft blotting paper, or fine flannel, be exactly fitted to the doors, and placed in the boxes, in lieu of the panes of glass: for glass is so cold in the winter, that it would chill every bee that happens to touch it; and is besides apt to collect water on the changes of weather. The paper, or flannel, should remain in the boxes till May, or till the fear of cold is past; and then be taken out, and the panes of glass be returned to their places.

When the state of the hives is enquired into in the spring, any hive which may have been reduced to a small number of bees, by any mischance, may be then strengthened by taking a sufficient number of bees from a strong hive, in the manner that has been directed for causing them to swarm. By means of this recruit the weak hive will soon thrive equal to any other hive. The number of bees added should be proportioned to their wants. It may be also observed that, in purchasing bees, those that swarm early should be preferred; for they will continue to be forward.

[Mr. WILDMAN will shew the practical part to any number of subscribers, that may not be fully satisfied, not less than twenty, in any place they shall please to appoint, not exceeding three miles from *London*; or to any subscribers at a greater distance, they paying his charges to and from *London*. And if any of the subscribers do not chuse to manage their Bees themselves, he will undertake it for the yearly Sum of Three Guineas.]

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A N

A C C O U N T O F B E E S,

EXTRACTED FROM

The Memoirs of the ROYAL ACADEMY of SCIENCES
at P A R I S.

OF all the insects known by naturalists, the bees are certainly the most admirable. The instinct they have for feeding themselves on flowers, and for gathering from thence the honey and wax; the regularity that reigns in their different functions, their government, their industry, the wonderful artifice of their works; in a word, all the properties that are observed in these animals, have drawn the attention of philosophers both ancient and modern.

Amongst the ancients, Aristomachus contemplated them for the space of fifty-eight years; *Aristomachum Solensem*, says Pliny, *duode-sexaginta annis nihil aliud egisse*; and Philiscus retired into woods, that he might have more convenient opportunities of observing them; *Philiscum vero Thasium in desertis apes colentem Agrium cognominatum: Qui ambo scripsere de his.*

AN ACCOUNT OF BEES.

We owe to Aristotle some very curious and useful observations on this insect, which have been embellished with all the charms of poetry by Virgil. Afterwards these observations were confirmed and enlarged by Pliny, and several other philosophers of antiquity.

Amongst the moderns, prince Frederic Ceci, institutor and president of the Roman academy of sciences, towards the beginning of the last century had wrote, according to the relation of Fabius Columna, a treatise upon bees, which he presented to the pope, Urbin VIII, and gave expectance of to the public, together with the description of the parts of this animal, *drawn* with the assistance of the microscope by Stelluti of the same academy: But it is not known what is become of that work, nor of that which Swammerdam promised several years ago, on the anatomy of this animal.

Swammerdam's History of Bees was written in Dutch; he left it, together with his other manuscripts, in legacy to his friend Mr. Thavenot. Mr. Thavenot died before he could perform the duty he owed to the memory of his friend in publishing his manuscripts. Mr. du Verney was so fortunate as to purchase those manuscripts, and by that means instrumental probably in preserving them; but being too much occupied in making new discoveries even to publish his own, it is no wonder that he should not perform his promise of publishing those of another. At last the illustrious Boerhaave, from his zeal for natural history, purchased them of Mr. du Verney, and engaged the learned Gaubius to translate them into Latin, and to get them printed in Dutch and Latin, which he hath executed. They make two volumes in folio, the last of which was published in the year 1738. The history of bees, which is contained in this work, answers the idea that Boerhaave had raised of it. [Vid. Reaumur's Histoire des Insects, tom. V. p. 208.]

Notwithstanding the observations of so great a number of learned persons, we have not forbore to examine this part of physics, wherein we have been *insensibly* engaged both by the pleasure we took in so curious an enquiry, and by the conveniency we had of a great num-

ber of glass hives in the garden of Mr. Cassini, adjoining to the observatory. As several moderns as well as the ancients have treated of the manner of governing these animals with regard to the *utility* which is to be derived from them, we shall not speak on that subject at present; but content ourselves with laying open the treasures of *curiosity* that we have discovered.

You will here see the origin of bees, the different species that are found in *one* swarm, the small number of those that are only for propagation, and the great number of the others that are occupied in labour. We shall explain how these gather on flowers the honey and wax, and how being employed in different functions they mutually assist each other in their labours. We shall give the description of the principal organs of bees, together with an explication of the construction of the cells and combs; a work of ingenious and learned architecture.

The *greatest part* of these observations have been sifted and examined several times, so that they carry with them an intire evidence. With regard to the *others*, that it will be easy to distinguish by the manner in which they are related, we were obliged to be content with conjectures, as they could not be known perfectly on account of the difficulties that attend such enquiries. For *here* nature is not only surrounded with obscurities, as on all other subjects; but she is moreover *armed* against those that approach her nearly, and would *closely* engage with her.

The number of bees in one hive is very different according to the different size of the hives. In the little hives we have counted eight or ten thousand bees, and have found even eighteen thousand in the larger.

Of the different species of bees.

In each hive, whether little or great, we have remarked three different sorts of flies. The first is what is properly called *bees*; this species composes almost the whole swarm. These are the bees,

AN ACCOUNT OF BEES.

that go and collect wax on the flowers, that knead it and form from it the combs and cells; these likewise gather the honey and fill with it the combs in summer,

—————*purissima mella*
Stipant, et liquido distendunt nectare cellas.

VIRGIL.

These fill the hollows of the combs, and swell
With liquid nectar ev'ry waxen cell.

that it may serve them for nourishment in the winter; these take care to supply their young with food adapted to their age, and to excite a proper heat to bring them to maturity,

Spem gentis adultos
Educunt fœtus.

These educate the young, or hatch the seed
With vital warmth, and future nations breed.

Lastly, These have the charge of keeping the hive clean, and of removing every thing that may be noxious. All these bees have a sting, and there are *some* amongst this species that are somewhat larger than others.

The second sort is what are called *drones*. They are easily distinguished from the rest by their colour, which is a little darker, and by their size; the drones being one *third part* longer and somewhat bigger than the bees. There are hives where one finds but a small number of drones, there are others where you will find a much greater quantity; and there are seasons of the year when we could find none,

Ignavum fucos pecus à præsepibus arcent.

All, with united force, combine to drive
The lazy drones from the industrious hive.

we have likewise sometimes found drones that were not bigger than the common bees. All the drones are destitute of a sting.

Lastly, we have remarked a third sort of bees in the same hive, which are longer still than the drones, but less big in proportion to their length, and of a more lively, reddish colour,

*Alter erit maculis auro squalentibus ardens,
 ————— insignis et ore,
 Et rutilis clarus squamis.*

With ease distinguish'd is the regal race;
 The monarch bears an honest open face;
 Of longer size, and godlike to behold,
 His royal body shines with specks of gold,
 And glitt'ring scales————

We have never found more than three of these bees in an hive, and oftentimes we have found but *one*. This third sort hath a grave and sedate walk, is armed with a sting, and is the mother of all the others. Perhaps it is this sort that hath been called the king.

I must observe that Aristotle had made the same distinctions, and hath given pretty much the same descriptions; although Mr. Maraldi hath not taken the least notice of it.

Κέντρον δὲ αἱ μὲν μέλιτται ἔχουσιν, οἱ δὲ κηφήνες οὐκ ἔχουσιν. Οἱ δὲ βασιλεῖς ἔχουσι μὲν, ἀλλ' οὐ τύπτουσι. ΚΑΛΟΥΝΤΑΙ ὑπὸ τινῶν ΜΗΤΕΡΕΣ, ὡς ΓΕΝΝΩΝΤΕΣ.——Οἱ δὲ φασιν ὀχεύεσθαι, καὶ εἶναι ἀρρενας μὲν τοὺς κηφήνας, Θηλείας δὲ τὰς μελίττας.

ARISTOT. Hist. Animal. lib. v. cap. 21.

As Virgil took his account of bees from Aristotle, it is a little surprising that he should not have preferred that opinion I have cited from thence, That what is commonly called the king, is really a female, and the mother of all the bees. This notion is, in effect, more prolific

of

of the marvellous, which is the life and soul of poetry; and that I do not offer a vague conjecture in thinking it more marvellous, I beg leave to refer the reader to Mr. de Fontenelle's *Plurality of Worlds*, towards the end of the 3d dialogue, where he will find the marvellous on this head, drawn out under a strict observance of truth, to a perfect astonishment. But besides this reason, we know that the very name of king was odious to the Roman people, and therefore one would think, the poet should have studiously avoided it, where his design was to celebrate the government of bees.

*Admiranda tibi levium spectacula rerum,
Magnanimosque duces, TOTIUSQUE ORDINE GENTIS
MORES; et studia, et populos, et prælia dicam.*

Of little creatures wond'rous acts I treat,
The ranks, and mighty leaders of their state;
Their people, government, and wars relate.

}

We have now enumerated the different sorts of bees, and shall proceed to the description of the bee.

Description of
the bee.

One may distinguish three principal parts in the body of the bee, *the head*, which is attached by a kind of neck to the rest of the body; *the middle*, or *breast*; and *the belly*, which is distinguished from the other by a cutting off in the middle.

In the head we shall content ourselves with observing two kind of talons or jaws, that are in the inferior part, and that open and shut from right to left. This organ serves the bees as hands for taking hold of the wax, for kneading it, for building cells with it, and for polishing them. They make use of these talons likewise for conveying *into* and *out of* the hive every thing that is necessary to them.

At

At the same extremity of the head, bees have a proboscis or trunk, the origin of which is near the neck. It goes tapering from its root, where it is bigger, quite to its extremity, where it terminates in a point.

This trunk is composed of five branches, two of which are detached from the others quite from their root, the one to the right, the other to the left; the three others do not separate from each other till about the middle of the trunk. The middle branch is cylindrical, of the bigness of a hair on a man's head, and when seen with a microscope it appears through its whole length distinguished into several rings, each of which is furnished with a great quantity of little hairs, that are longer towards the extremity of the trunk than towards its root. *This part*, which we call more properly the trunk, is one of the principal organs of bees, with which they gather the honey on flowers, as we shall mention afterwards, and with which they take their nourishment.

The other four branches are larger towards their origin, and go tapering on to the very *point*. They are made in the manner of a *gutter*, being concave of that side which is towards the trunk, and convex of the other; they have the consistence of horn; the two branches which are detached the nearest from the root are the largest and inclose the two others. They unite so well together, that they seem to make but one single tube.

Towards the middle of the length of each of these four branches there is a sort of articulation, by means of which they *extend* themselves, or *bend* all at once at the place of articulation. The half of the trunk that is at the extremity bends itself inwards, and lays itself along the other half which is towards the origin; these four branches by bending themselves carry with them the proboscis or middle trunk, which hath no articulation. When these branches are *bent inwards*, (which is their most common situation) they are contained
between

between the neck and the talons, that were mentioned before; but when they are *lengthened out* (which happens as often as the bee would feed itself or gather honey) the other half advances forth from the head, and besides *that* the middle branch of the five can lengthen itself a little beyond the others, and move itself in all directions in order to *suck* with its extremity the honey from the cups of flowers.

We have been assured by several observations, that the bees gather honey by the proboscis *alone*, and it hath appeared to us that this trunk is a pipe through which the honey can pass. We have even seen the trunk grow bigger and less by turns; we have seen it *swell* the very instant that the bee sucked honey, and this enlarging and lessening was propagated successively from its extremity quite to its root, which made us judge that it was the juice that caused the swelling, as it passed through the capacity of the pipe.

It may be supposed that the proboscis or middle trunk, is in the nature of a tongue*, and that the branches perform the office of a bill; the tongue, after having sipped the honey from a flower, conveys it by means of the branches, quite to their roots, where it is received into the body of the bee in a kind of reservoir. These are the principal parts of the head and their uses, as far as their smallness will permit us to know them.

The middle or breast of the bee is of a figure approaching to an oblong spheroid, to which are fastened two wings, one to the right, the other to the left. Each of these wings is accompanied by another which is as it were adherent to it, but smaller than the other that is nearest to the head; it is with these four wings that they make sounds or hummings, in order to give notice one to another.

* Mr. de Reaumur conjectures, that the tip of the proboscis rather performs the office of a tongue in lapping; and that the liquor is conveyed along the pipe, by the alternate dilatation and contraction of muscles: if so, what a delicate apparatus must there be of invisible muscles!

Fit sonitus, mussantque oras et limina circum.

Around the entrance make a drowsy hum.

It is likewise in this part of the body, towards the under side, that are situated six legs, three on the right, and three on the left. Two of these legs are on the fore-part, and very near the head; they are the least of the six: the four others are attached on the back-part towards the belly, very near the one to the other: the two middlemost are a little longer than the first, and shorter than the hindmost. All these legs are distinguished by several joints, of which there are *three* greater than the rest; besides those *three* joints that are towards the middle of the leg, there are likewise *others* towards the root and towards the extremity of each leg. The middlemost joint of the two hinder legs is much larger than the others, and there is on the external side a little concavity, in the shape of a marrow-spoon, which is surrounded by a great number of small hairs; it is in this *hollow* that the bees collect, by little and little, the particles of wax, which they gather on flowers. It must be observed, that the *legs* of drones who do not gather wax, and *those* of the king, or more properly the queen of the bees, have not this groove.

The extremities of the six feet terminate in two hooks, *with their points opposite to each other*, with which the bees fasten themselves in clusters to the sides of the hive, and form divers figures, sometimes of a cone, and sometimes of a garland, &c. From the middle of these two hooks, there comes out a little thin appendix that folds itself double through its whole breadth; its usual state is to be folded, and when it is extended it appears twice as big; the bees make use of this part for fastening themselves, and for walking on polished bodies, such as glass: I believe likewise that they make use of this part as of hands, to take the little particles of wax

C

upon

upon the flowers, and to transmit them to the two hinder feet; for it is not probable that the *books* can serve for that purpose.

The last part of the bee which is the belly is distinguished by six rings. In the inside we shall remark two *parts*, the one is a little bladder or reservoir, in which is collected the honey that the bees sip in the cups of flowers, after it hath passed through the proboscis and through a very narrow pipe that traverses the head and breast of the bee. This bladder, when it is full, is of the size of a small pea, it is transparent in such manner that you see through it the colour of the honey it contains.

The other remarkable part is the sting, which is situated at the extremity of the belly of the bee, and which is drawn *in* and darted *out* with great quickness, by means of certain muscles placed very near the sting; the length of the sting is about two lines; it is a little bigger towards its root than near its extremity, which terminates in a point. It hath the consistence of horn; is hollow within in the manner of a tube, wherein passes the venomous liquor, which being included in a bladder placed in the belly, and at a little distance from the root of the sting, discharges itself near the point, and insinuates itself into the wound, the very instant that the bee pierces the skin.

The bee leaves almost always the sting in the wound, and the sting draws after it the bladder, and sometimes a part of the guts of the insect.

*Illis ira modum supra est, læsæque venenum
Morsibus inspirant, et spicula cæca relinquunt
Adfixæ venis, animasque in vulnere ponunt.*

Prone to revenge, the bees, a wrathful race,
When once provok'd, assault th' aggressor's face.
Their latent stings an easy passage find,
And wounding leave their very souls behind.

If

If care be taken to draw out immediately the sting from the wound, there will be only a little tumour, because you do not give time sufficient for the venom, that issues from the bladder, to enter into the wound; but if you are not diligent to draw the sting out, all the venom discharges itself from the bladder, and enters in a little time into the wound, which causes a great swelling with a pain that lasts sometimes several days.

One of the first occupations of the bees, after the new swarm is lodged in an hive, is to form cells. They apply themselves to this work with so much diligence, that we have seen them make, in one day, a comb which was a foot long and six inches wide, that, according to the usual size of cells, might contain near four thousand.

They begin their work by fastening it to what they find most solid in the upper part of the hive, and they continue it from above *downwards*, and from one side to the other. In order to attach it more firmly, they employ sometimes a wax which is a sort of glue.

It is not easy to know, in particular, the manner in which they employ themselves at this work, on account of the number of bees that are in motion, where there appears to the sight scarce any thing but confusion. We have been able however, to observe the following particulars. You see bees bearing each in their talons a little piece of wax, and running to the places where they are at work upon the combs. When they are arrived thither, they fasten their wax to the work by means of the same talons, which they apply sometimes to the right and sometimes to the left. Each bee is employed on this work but for a short time, after which she goes away; but there is so great a number that succeed one after another, and with such expedition, that the comb continues increasing very perceptibly. In proportion as *some* bees work in the construction of the cells, there are *others* that pass and repass several times, beating with their wings and with the hinder part of their body upon the

work itself, which seems to serve no other purpose than to make it more solid and firm.

The order they observe in the construction of the cell is this. They begin with laying the basis, which is composed of three rhombus's or lozenges. They build first one of these rhombus's, and draw two *faces* on two of the sides of the rhombus; they add a second rhombus to the first in a certain *inclination*, and draw two new *faces* on the two sides of that rhombus; lastly, they add a third rhombus to the two first, and raise on the two external sides of this rhombus two other faces, which with the four others form the cell, that by this disposition of the basis becomes necessarily of an hexagonal figure.

Whilst a part of the bees is occupied in the construction of the *cells*, there are others of them employed in *perfecting those* that are newly modelled; which they *do* by means of their talons, with which they *round* the angles in an exquisite manner, and *finish* the sides and bases with so great a delicacy, that three or four of these sides placed one upon another, have not more thickness than a leaf of common paper; and because on account of this delicacy the entrance of the cell, which is just adapted to the size of the bee, would be apt to break; therefore to prevent this rupture, they *fortify* the entrance of each cell with a border of wax*.

We have said that the bees which build cells are commonly employed in it but a *little while* at a time; but it is not *so* with regard to those that polish them, for they work a long while and with great expedition, and they never intermit their labour unless it *be* to carry out of the cell the particles of *wax* which they take off in

* ——— *grandævis oppida curæ,
Et munire favos, et dædala fingere testæ.*

The aged insects fortify each part,
And shape the fret-work of the combs with art.

polishing. In order that *this* matter should not be lost, there are other bees attentive to receive *it* from those that polish, or who go to take *it* up in the cell itself, from whence the polisher retires for a moment, and carry *it* to be employed in some other place.

There are other bees destined to aid those that polish, for one often sees *attendants* on them to give them either honey, or some other liquor necessary for their works, or for their own nourishment.

Each comb hath two rows of cells opposite to each other, which have their *common* bases. The thickness of each comb is a little less than an inch; thus the depth of each cell will be about five lines. We have found in divers combs, that were a foot long, between sixty and sixty-six ranges of cells; there will therefore be a little less than two lines for the breadth of each, which is a little more than a third of its length.

Almost all the combs are built with cells of this size; except a small number of others in some places of the hive which have larger. The breadth of these cells is something more than three lines, and the length about six lines. These great cells are made for lodging *worms* that become drones, as we shall mention afterwards.

One finds likewise, in divers parts of the hive, three or four cells bigger than the others, and made in a different manner. They have the figure of a spheroid, they are open in the inferior part, and attached to the extremities of the combs. We could not discover to what purpose these cells are designed, but we suppose them the cradle or the abode of the kings.

The bases of all the combs are placed at such distance one from another, that when the cells are finished, there remains between one comb and another, only a sufficient space for the passage of two bees a-breast. These combs are not continued from top to bottom,

bottom, but they are often interrupted; and besides *that*, they have openings from space to space, which give a more easy and a shorter communication from one to another.

After having explained in what manner the bees build the cells, it is necessary to consider more particularly their construction.

Every basis of a cell is formed by three rhombus's almost always equal and alike, which according to the mensurations we have taken, have the two *obtuse* angles each of one hundred and ten degrees, and consequently the two *acute* each of seventy degrees.

N. B. Mr. Maraldi had found by mensuration, that the obtuse angles of the rhombus's were 110° nearly; upon which he observed, that if the three obtuse angles which formed the solid angles above-mentioned, were supposed equal to each other, they must each be of $109^{\circ} 28'$; from whence it has been inferred, that this last was really the true and just measure of them. Mr. de Reaumur desired Mr. Kœnig, a worthy pupil of the famous Bernouillis, to seek what should be the quantity given to this angle, in order to employ the least wax possible in a cell of the same capacity; and that gentleman found, by a higher geometry than was known to the ancients, by the method of infinitesimals, that the angle in question ought, in this case, to be of $109^{\circ} 26'$. This observation by the famous mathematician Mr. Kœnig, was afterwards verified by the excellent Mr. Mac Laurin, who hath shewn the advantages arising from this construction of the cells. Mr. Mac Laurin very justly observes, that the bees do truly construct their cells of the best figure, and that not only nearly, but with exactness; and that their proceeding could not have been more perfect from the greatest knowledge in geometry. How they arrive at this, and how the wonderful instinct in animals is to be accounted for, is a question of an higher nature*; this

* *His quidam signis atque hæc exempla secuti,
Esse apibus partem divinæ mentis, et haustus
Ætherios dixere. Deum namque ire per omnes
Terrasque, tractusque maris, cælumque profundum.*

this is surely a remarkable example of this instinct, which has suggested a problem that had been overlooked by mathematicians, though they have treated largely on the maxima and minima; and such an one, as has been thought to exceed the compass of the common geometry.

Vid. Philosophical Transactions, N^o. 471. and Martyn's Abridgement, vol. ix. p. 2.

The bee that is named the king is in reality the mother of all the others. She is so prolific, that, as far as one can judge, she may produce in one year eight or ten thousand young ones; for she is commonly a part of the year *singly* in a hive, and at the end of summer the hive is as full of bees as in the beginning of the spring, yet there goes out every year a *swarm*, and sometimes *two* or *three* of ten or twelve thousand *each*; it follows therefore that this royal bee must produce a part of those different swarms: I say, *a part*, because it is possible that the new king, who goes out with the fresh swarm, may produce likewise a part of them before the migration.

Of the origin
of bees.

The royal bee is most commonly concealed in the most secret part of her palace, and is never visible but when she would lay her young in the combs that are exposed to light.

It was on those rare occasions that we perceived her; indeed she is not even *then* always visible, for most commonly there is at those times a great number of bees, that fastening themselves one to another, hang down in the form of a veil from the top to the bottom of the hive, which hinders your sight, and they do not retire till the bee hath laid her young.

Whenever she hath appeared to us *unveiled*, she was always attended by ten or twelve of the stoutest bees amongst the common sort, that make a kind of retinue, and follow her wherever she goes with a sedate and grave tread,

Præterea

Induc'd by such examples, some have taught
That bees have portions of celestial thought:
Endued with particles of heav'nly fires:
For Mind the whole created world inspires.

*Præterea regem not sic Ægyptus, et ingens
Lydia, nec populi Partiborum, aut Medus Hydaspes
Observant——*

*Illum admirantur ; et omnes
Circumstant fremitu densò, stipantq; frequentes.*

No prostrate vassal of the East can more
With slavish awe his haughty prince adore :
Him all admire, and him their guardian own,
Crowd round his court, and buz about his throne.

Before she lays her young, she puts, for a moment, her head into the cell where she designs to lay them ; if she finds this cell empty, and there is not in it, either honey, wax, or any embryo, she turns herself immediately to introduce the posterior part of her body into the same cell, and sinks into it till she touches the bottom. At the same time the bees, her attendants, who are disposed in a circle round her, having all their heads turned towards *her's*, pay a sort of homage with their proboscis and feet, caress her, and give her all kinds of entertainment, which lasts however but a very *little while* ; after *that* the bee leaves the cell, and you may discern a little white egg, very small, about half a line long, or three quarters of a line at most, yet four or five times longer than it is big, a little more *pointed* at one extremity than at the other, and planted by its *least* extremity on the basis in the solid angle of the cell. This egg is formed of a membrane, thin, white, smooth, and full of a whitish liquor.

Immediately after the pregnant bee hath laid an egg in one cell, she goes with all the same circumstances, and escorted by the same number of bees, to lay another egg in a neighbouring cell ; and we have seen her lay in this manner eight or ten in different cells successively one after another. After having finished her *delivery* she withdraws, attended by the same bees, into the secret apartments of the hive ; where she is lost out of sight.

The

The egg which remains on the basis of the cell continues four days in that state without changing figure or situation; but after the four days you see it changed in the manner of the caterpillar, divided into several rings, laid and applied on the same basis, and twisted round, so that the two extremities touch each other. It is *then* surrounded by a little liquor, which the bees take care at the end of the four days to put in the solid angle of the basis. We could never discover the nature of this liquor on account of its small quantity; which hath left us in doubt, whether it might be honey that the bees carry thither for the nourishment of the embryo, or rather some matter proper to fecundate the sperm; for it appeared to us more whitish, less liquid, and less transparent than honey.

Of whatever nature this first liquor may be with which the little worm is surrounded, it is certain that afterwards the bees bring it honey for nourishment. In proportion as it grows they supply it with a greater quantity of food, quite to the eighth day from its birth, when it is increased in such manner that it occupies the whole breadth of the cell and a part of its length. After that, the care of the bees for the young ones ceases, for they stop up with wax all the cells, where these worms continue still shut up for twelve days. During that time, there happen to the embryos inclosed divers changes; which we have discovered by opening these cells on different days from the time they had been stopped. At first the worms change their situation, and from being twisted round, as they were before on the basis of the cell, they extend themselves along its whole length, and place themselves with the head turned towards the mouth of the cell; the head of the worm begins to shew itself a little, and you see a small *extension*, which is, in my opinion, the beginning of the proboscis. You see likewise upon the origin of the head a black point, and at a little distance from this point a black streak upon the back, which doth not reach quite to

D

the

the extremity of the worm ; the first lineaments of the feet likewise appear, but very small.

After the head is formed, and the proboscis lengthened, all the other parts display themselves successively ; so that the whole worm is changed into an *aurelia* or nymph, which is the fly almost perfect, except that it is yet white and soft, and that it hath not that kind of crust with which it is covered afterwards.

By this transformation the worm strips himself of a white and very fine pellicle, which is so perfectly attached to the internal sides of the cells, that it takes even the turns and bendings of the angles as well of the basis as of the sides, and appears to form but one body with them.

The bee being stripped of this pellicle, and all the parts unfolded by degrees and changed through successive colours from a yellow to a black, arrives at perfection by the *twentieth* day from the birth. From *thence* she endeavours to issue from the cell, and makes the opening herself by cutting round with her jaws or talons the *cover* that stopped up the mouth of the cell, *which* the bees had made to inclose her. The new bee when she first quits the cell, appears a little drowsy, but she soon assumes the natural agility, for we have seen her the same day issue from the cell and return from the fields loaded with wax like the rest. You may distinguish these young bees by the colour, which is a little more blackish, and by the hairs, which are somewhat whiter.

As soon as the young bee hath sallied from the cell, there come immediately *two* of the old bees, *one* draws out the cover, kneads, and employs the wax elsewhere of which it was composed ; the *other* labours to repair the breach ; for the cell having been disordered by the new-flown bee, an old one restores its symmetry, gives it

it its former hexagonal figure, fortifies it with the usual border, and cleanses it by taking away the little pellicles of the young bee which have remained there. These pellicles of bees which are attached to the cells occasion them to change colour, and it is on this account that you find in a hive, combs of different colours, those in which there hath been nothing but honey being of a bright yellow, whilst those, from whence bees have issued, are of a dusky yellow. We have taken away, sometimes from a cell, which had been the cradle of several bees, eight of these pellicles placed one upon another.

The cells being restored to their former perfection, the bees sometimes lay new eggs in them on the same day: sometimes they put honey in them first; we have seen bees lay their young in the same cells five different times in a little more than three months.

The bees gather two very different sorts of wax. The first, which is brown and gluish, serves them for stopping up all the vent-holes of the hive, and sometimes as a support for fastening the combs to the hive. Of the manner in which bees collect wax.

—————*tenuia cerâ*

*Spiramenta linunt, fucoque et floribus oras
Explent, collectumque hæc ipsa ad munera gluten,
Et visco et Phrygiæ servant pice lentius Idæ.*

A smearing wax they get, and thus contrive
To stop the vents and crannies of the hive:
Not birdlime, or *Idean* pitch produce
A more tenacious mass of clammy juice.

The second sort is the common wax, which they employ in the construction of the cells.

—————*pars intra septa domorum,
Narcissi lacrimam, et lectum de cortice gluten,
Prima favis ponunt fundamina, deinde tenaces
Suspendunt ceras.*

AN ACCOUNT OF BEES.

Narcissus' tears they temper with a gum,
 For the first ground-work of the golden comb :
 On this they found their waxen works, and raise
 The yellow fabrick on its glewy base.

The bees gather the *common* wax upon the leaves of a great number of trees and plants, and on the greatest part of flowers that have *stamina*.

—————*pascuntur et arbuta passim,*
Et glaucas salices, casiamque, crocumque rubentem,
Et pinguem tiliam, et ferrugineos hyacinthos,
Purpureosque metunt flores——hinc arte recentes
Excudunt ceras.

On various shrubs, and saffron buds they feed,
 On bending osiers, and the balmy reed.
 From purple flow'rs and hyacinths they bring
 Their gather'd sweets, and rifle all the spring.

They often load themselves entirely from *one* flower ; but they work with such a prodigious quickness, that whatever attention you give in observing them, the eye can scarce keep pace, and ascertain the manner in which they act. It is certain, however, that they sometimes gather up the wax with the hairs that garnish their bodies, by rolling themselves on the flower ; for you see them return from the fields with their hairs loaded with little particles of wax resembling dust : but this only happens when the mornings are moist, the moisture that is then on the flowers preventing perhaps the particles from being easily *compacted* into that part of the body where they are accustomed to place them. When they are arrived at the *bive*, the heat *there* causing the moisture to evaporate, they easily brush off with their feet the wax upon their hairs, and collect it together.

They

They *commonly* gather up the particles of wax with their talons and the two fore-feet, from these they convey the *particles* to the middle feet, which afterwards transmit *them* to the middle joint of the two hinder feet, where you find the little mass collected of the bigness and shape of two small lentils.

Crura thymo plenæ :

Their feet and thighs with flow'ry spoils replete.

That joint is much larger than the others, as we have mentioned before, and hath a little concavity in the shape of a spoon, which is well adapted for containing the mass; moreover this concavity is surrounded by little hairs, which serve, as I may say, in the nature of fingers *forboding* the wax in that place, in order that it may not fall out when the bees return to the hive.

Besides these means which nature hath furnished them, they take likewise other precautions not to lose the fruit of their labour. In proportion as the bees transmit the particles of wax to their hinder legs, they *compress* these particles together; this they *do* by means of the two middle feet, which they push backward and apply several times and in different directions upon the wax. They take this care principally, when loaded with a sufficient quantity of wax, they are ready to fly and return to the hive: If the flowers on which they rest, have not sufficient consistence, or are agitated by the wind, they seek some more *stable* place, and that is more proper to resist the little compressions they make on the wax.

The bees being arrived at the hive unload themselves of the common wax in two different manners. Supporting themselves on their two fore-feet, they make several motions of the wings and body, sometimes to the right, sometimes to the left; and, as if this motion, and the buzz that the wings make in consequence of

it, was to give notice to their companions within, there come three or four that take each a small portion of wax with their talons,

Aut onera accipiunt venientum.

Receive the burdens of returning bees.

To these first succeed several others that take every one their share, till there remains no more wax on the leg of the bee: after which she returns to the fields to make a new collection.

It is likewise in this manner that they unload themselves of the other sort of wax which is, to speak more properly, a kind of glue.

Et visco et Phrygiæ——pice lentius Idæ,

Not birdlime, or *Idean* pitch produce

A more tenacious mass of clammy juice.

which sticks so fast to the leg of the bee that is loaded with it, that it is necessary for the *bees* that unload her, and for *herself*, to exert their whole force, and to fasten themselves whilst they pull in order to draw it off.

But when there is in the hive a great number of cells where they may deposit the common wax, they practise a more expeditious method, and that requires no assistance. The bee which is loaded, goes in quest of a cell in which there is neither honey nor any worm; having found one, she fastens herself by the two fore-feet upon its superior border, after *that* she bends the body a little forward in order to put her two hinder feet into the cell; in this situation she thrusts back her middle feet, one on *this side*, another on *that*; and sweeping with them from top to bottom along the two hinder legs, where the two lenticular masses are collected, she detaches them by this means and deposits them in the cell.

There are some bees that content themselves with *leaving* the wax in that part of the cell, where it chances to fall when they detach it from their feet, without giving themselves the trouble to *dispose* it; but the greatest part, after having unloaded themselves, enter into the cell and range very neatly at the extremity of it the two little bodies of wax by side each other: That done, the bee retires.

Almost immediately there comes another; there are even *some* waiting till the first bee is gone out, in order to enter and perform their respective offices. If the two pieces of wax are not ranged as we have mentioned, *they* carry them to the farther extremity of the cell, and dilute them, with their two jaws, for the space of half a quarter of an hour; so that those two little bodies are reduced to a kind of paste that takes the figure of the cell as in a mould; which gives one reason to think, that the bee, in diluting the wax, mixes with it some liquor, either honey, or perhaps only a mere moisture that naturally oozes at the place where they are accustomed to *store* their honey.

Several other bees come to unload themselves in the same manner in the same cell, and as fast as one unloads herself of the wax, there comes another immediately to perform the same office of diluting it, till the cell is almost full of that sort of wax, which is piled up sometimes in *stories* of divers colours, white, yellow, red, and brown, according to the flowers or leaves on which the wax hath been gathered by different bees.

One finds in several places of the hive a great number of cells full of this wax, which are as so many magazines, to which they have recourse on occasion, because as they have need of it a great part of the year at certain times, in order to *cover* the *cells* where their young are inclosed, and to stop up *those* that are full of honey, it is necessary they should have stores and provisions of it.

The

The *wax* which is found in the cells is not however so perfect as *that* of which the combs are formed; for although the former be diluted with moisture, it crumbles into dust when pressed between the fingers, whereas the other wax is a kind of compacted paste; it is necessary therefore that the bees, before they employ it in the construction of the combs, should give this wax some sort of *preparation*. What still further evinces *this* is, that the wax included in the cells, which is often of different colours, is always white immediately after the combs are built.

Of the manner in which bees gather honey.

The bees gather honey on the flowers whose calyx or cup is not much deeper than the length of their proboscis; but there is so little honey in each flower, that they go over a great number,

Floribus insidunt variis,

On various flow'rs they fix their short abode.

before they can collect a sufficient quantity to fill their little bladder, which is the reservoir where it is gathered together, as we mentioned in the beginning. The very instant a bee settles on a flower, she extends her proboscis quite to the bottom of the *cup*, from whence she sucks the honey. When their bladders are full, the bees return to the hive, and carry the honey into a cell, *disgorging* it by that part of the head which is between the two jaws or talons, that they lengthen out more than usual, and which they seldom keep open. They deposite the honey with stirring the head sometimes on one side sometimes on the other; and when there happens to be a drop not well ranged, they extend their proboscis to gather it up again, and place it in the same order as the rest. As the *honey* that a single bee can carry at once is but a small part of *that* which a cell can contain, it requires the honey of a great number of bees to fill each cell.

When

When the cells are full of honey, if the bees would hoard it up for winter, they stop up the cells by making a thin cover of wax; but those cells, where the honey is designed to serve for daily food, remain open, and at the disposal of the whole swarm.

—————*in medium quæsitâ reponunt.*

Lay up the stores they get for common use.

The honey which they reserve the *last* for their food, is always put into the most inaccessible place, that is to say, in the upper part of the hive, if it hath no *external cover* that can be taken off; but if it hath *one*, they leave in the upper part *empty* combs, and place the honey towards the middle of the hive.

Besides what we have mentioned hitherto with regard to bees, nature hath furnished them with other talents, which we have thought it our duty to remark. They love cleanliness and do every thing in their power to preserve it.

Divers particularities of bees.

*Neu propius tectis taxum sine, neve rubentes
Ure foco caneros, altæ neu crede paludi,
Aut ubi odor cæni gravis;*

Let them not near the baleful yew tree dwell,
Nor broil crabs near, which give a nauseous smell,
Nor near the steaming stench of muddy ground
Place their abodes ———

The glue that they gather serves them for covering with a kind of mastic the glass-windows round the hive, and the hive itself round the pedestal, insomuch that by this means they hinder the entrance of the least insects.

E

—————*nam*

—nam sæpe favos ignotus adedit
 Stellio, et lucifugis congesta cubilia blattis:
 Aut asper crabro imparibus se immiscuit armis;
 Aut dirum tineæ genus, aut invisa Minervæ
 Laxos in foribus suspendit aranea casses.

For lurking lizards often lodge, by stealth,
 Within the suburbs, and purloin their wealth:
 Oft broods of moths infest the hungry swarms,
 And oft the furious wasp their hive alarms
 With louder hums, and with unequal arms.
 Or else the spider at their entrance sets
 Her snares, and spins her bowels into nets.

There are some bees that remain centinels at the mouth of the hive,

Sunt quibus ad portas cecidit custodia sorti,

Some are appointed centries at the gate,

in order to oppose the insects that would pass by the entrance, and when *one* bee is not sufficiently strong to guard it, several others come to her succour.

We should be tedious if we were to relate *all* that we have seen done remarkable on such occasions. It will be sufficient to mention, that a snail which had entered into the hive, notwithstanding the resistance of several bees, after having been killed by their stings, was embalmed all over with that mastic we have mentioned, as if with design to prevent either the stink that the putrified flesh would occasion in the hive, or to avoid the worms which that corruption might produce.

Nature hath endued the bees with an exquisite smell, for they scent at a great distance the honey and wax.

They

They have divers manners of giving each other *pleasure*, of which they appear extremely *sensible*. They are likewise subject to fight and kill each other, not only in single combat, but *general battles*; yet *this* never happens in common, unless in autumn the harvest of honey is not sufficient for the support of the whole swarm during the winter.

Virgil, instead of this physical cause of their civil wars and destruction, assigns a political reason;

————— *nam sæpe duobus*

Regibus incessit magno discordia motu.

Continuoque animos vulgi, et trepidantia bello

Corda licet longe præsciscere: namque morantes

Martius ille æris rauci canor increpat, et vox

Auditur fractos sonitus imitata tubarum.

Tum trepidæ inter se coeunt, pennisque coruscant,

Spiculaque exacuunt rostris, aptantque lacertos,

Et circa regem atque ipsa ad prætoria densæ

Miscentur, magnisque vocant clamoribus hostem.

If once two rival kings their right debate;

And factions and cabals embroil the state;

The people's actions will their thoughts declare,

All their hearts tremble, and beat thick for war;

Hoarse broken sounds, like trumpets harsh alarms,

Run through the hive, and call them forth to arms;

All in a hurry spread their shiv'ring wings,

And fit their claws, and point their angry stings:

In crowds before the king's pavilions meet,

And boldly challenge out the foe to fight;

No sense of danger can their kings controul,

Their little bodies lodge a mighty soul.

I cannot find that Virgil hath copied this reason from any of the ancient naturalists preceding his time, it seems therefore to be a mere

fiction of the poet, with a view perhaps to throw an odium on regal powers; as Horace hath likewise delicately flattered the Roman disdain of kings with

—————*Delirant reges, plectuntur Achivi.*

For kings are madmen, and their subjects we.

It seems as if the bees had some foresight of *fine* and *bad* weather, for not only they do not go out when there is an appearance of wet weather,

Inque vicem speculantur aquas, et nubila cæli;

By turns they watch, by turns survey the skies,
To judge if threat'ning rain, or tempests rise.

but when a storm seems to threaten at the time they are in the fields, they escape it by quitting their labour, and arriving at the hive almost all at once, and with great precipitation.

*Nec vero a stabulis pluviâ impendente recedunt
Longius, aut credunt cælo, adventantibus euris;
Sed circum tutæ sub mœnibus urbis aquantur,
Excursusque breves tentant, et sæpe lapillos,
Ut cymbæ instabiles fluctu jactante suburram,
Tollunt; his sese per inania nubila librant.*

None range abroad when winds or storms are nigh,
Nor trust their bodies to a faithless sky;
But make small journies, with a careful wing,
And fly to water at a neighbouring spring:
And lest their airy bodies should be cast
In restless whirls, the sport of ev'ry blast,
They carry stones, to poise them in their flight,
As ballast keeps th' unsteady vessel tight.

Nothing

Nothing agrees better with bees than heat; the greater it is, the more animated they are, the more lively for labour: cold on the contrary is so injurious to them, that however animated they were within the hive, when they go out of it in the winter they are numbed and struck almost immediately motionless.

—————*contracto frigore pigræ.*

With cold benumb'd unactive they remain.

If you bring them near the fire, the warmth they receive from thence reanimates their former vigour.

In order to defend themselves from cold during winter, they crowd about the middle of the hive as near to each other as they can be in the space that is between two combs. There they stir themselves from time to time, without changing place, and this motion excites a warmth that protects them from the external cold: The heat is so great by this agitation, that it is communicated to the glass windows of the hive, where it is very sensible to the hand that is applied.

It is probable that they succeed one another by turns in labouring, because they work night and day in the hive, and there is a part of the bees that repose themselves even in the day-time.

Virgil on the contrary, following Aristotle, says,

Omnibus una quies operum, labor omnibus unus.

All work together, all together rest.

Their repose however doth not cease to contribute to the public good: for their presence in the hive causes a warmth, which serves to breed the young that are inclosed in the cells, as we have discovered by the following experiment.

We have sometimes broke off large pieces of combs, where there were little worms in the cells, and left them at the bottom of the hive. A great number of bees have gone and placed themselves on those broken combs, and continued *there* till all the brood have sallied forth in the form of bees. This experiment shews moreover the care that the common bees take of the young ones.

*Solæ communes gnatos, consortia tecta
Urbis habent.*

Of all the wing'd inhabitants of air,
These only make their young their common care;
In well-dispos'd society they live,
And laws and statutes regulate the hive.

We have discovered that they have divers manners and different motions by which they *understand* one another; as, for example, when a bee that is at work on the combs demands honey of one that is just arrived; she that wants the honey extends her proboscis and puts it between the talons of her that is to give the honey; in proportion as the *latter disgorges* it, the other receives it with the proboscis, without spilling a drop.

They *understand* one another likewise, *when*, by a motion of their wings, they ask, as it were, to be unloaded of the wax, which they have gathered in the country; likewise *when* in the morning they rouse each other to go out to work:

Mane ruunt portis, nusquam mora.

At morn rush out, their diff'rent tasks pursue;
Sit on the bloom and suck the rip'ning dew.

Lastly, *When* several bees would quit a place, if one makes a motion with her wings which causes a little buzz, all the others following the example make the same motion, and retire. I imagine,
that

that it is in this manner they give notice in the hive, *when* they are preparing to sally forth for making a new swarm.

The drones are commonly a third *bigger* and *longer* than the bees; Of the drones, their head is rounder and more full of hairs. It is certain they have no sting, and their *internal* parts are very different from *those* of the common bees.

One rarely sees them go out of the hive, and whenever they do go out, it is not till two or three o'clock in the afternoon, and never but in fine weather. They do not return loaded with wax; but we have found their bladder or reservoir *full* of honey as in the common bees, whether it be that they have collected it in the fields, or that they took it in the hive before they went out, which latter we are the most inclined to believe, because we have never seen them settle upon flowers, and after they have returned into the hive, we have never seen them lay the honey in the cells;

Immunisque sedens aliena ad pabula fucus.

And drones that riot on another's toils.

We are even apt to think that they have not the organs for *disgor-*
ging it, as the other bees *do*; for in the other bees you cannot compress, ever so little, that part of the body which is opposite the bladder when it is full of honey, but you see the honey *issue* immediately at that part of the head by which they are accustomed to discharge it into the cell; whereas it is not so with regard to drones, although after having opened them, their bladder hath been found quite full of honey.

In some hives the drones are few in number, in others they are extremely numerous. During a part of the summer they are *dispersed* in the hive. Afterwards in proportion as their number increases, they *assemble together* in companies, in different parts of
the

the hive, where they continue cantoned and almost intirely motionless.

At the time that the swarm sallies forth, and that the bees are all in motion, the drones keep their place, and do not go out with the swarm, or if any attend the colony, they are only a few in number. But from the end of July to the middle of August, these drones are attacked by the common bees,

————— *agmine facto*

Ignavum fucos pecus à præsepibus arcent.

All with united force combine to drive
The lazy drones from the industrious hive.

Several bees fall upon a single drone and seize him by his wings and body; and although the drones resist as much as they are able, they are obliged to withdraw and leave the hive; they disappear so intirely, that we never could discover what was become of them.

When this sort of combat happens, you see all these animals in great commotion, as well without as within the hive. All the drones are so generally expelled, that of several hundreds, which we have often remarked in one hive, by the end of October we have not found a single drone in several hives that we have examined.

Their origin is the same as that of the bees, they are the offspring of the queen, and produced in the same circumstances, with this difference alone, that the drones are lodged in separate combs made expressly for them.

We have said that in an hive there are combs whose cells are a third or an half bigger and longer than the common cells. The pregnant bee chuses these great cells for depositing there, with all the same state and attendance, as we have mentioned with regard to the common bees, those eggs from which the drones are to be hatched,

hatched, and which cannot be distinguished by the sight from the common eggs; but it is probable that the mother hath some exquisite *feeling* to distinguish them, since she allots them abodes, proportioned to the size they are to have when they are inclosed in the cell in their utmost perfection. The drones undergo the same metamorphoses as we have remarked of the bees; they are as many days before they sally forth from their cells, and become *recluses* after the eighth day from their birth.

Lastly, they are nursed with the same care and tenderness as the common bees: but it is surprising that this attention and love which the bees have for those *little ones*, should be turned, as I may say, into so great an hatred at the end of summer. This hatred is so universal, that it spares not even the young drones, who are yet only worms or nymphs included in the cells; for we have often remarked that at the time that a part of the bees have been expelling the great drones from the hive, there were other bees employed in unstopping the cells where the *imperfect* drones were inclosed, in dragging them out of the cell, in killing them, and throwing their bodies out of the hive; where we have sometimes seen two or three hundred killed of different ages.

Mr. Maraldi, by a nice examination of the internal structure of the drones, which differs in some respects from that of the bees, discovered some resemblances to the male organs of generation; and from thence conjectures that they are the males of the bee-insect*; yet he could never discover them in the act of copulation. The ancients were inclined to think that there was no conjunction of sexes amongst bees.

*Illum adeo placuisse apibus mirabere morem,
Quod nec concubitu indulgent, nec corpora segnes
In venerem solvunt, aut fœtus nixibus edunt:
Verum ipsæ è foliis natos et suavis herbis*

* Whereas the common bees are of neither sex.

AN ACCOUNT OF BEES.

*Ore legunt: ipsæ regem parvosque Quirites
Sufficiunt, aulasque et cerea regna refingunt.*

But of all customs which the bees can boast,
'Tis this that claims our admiration most,
That none will *Hymen's* softer joys approve,
Nor waste their spirits in luxurious love:
But all along virginity maintain,
And bring forth young without a mother's pain.
From herbs and flow'rs they pick each tender bee,
And thus collect a buzzing progeny.
From these they chuse out subjects, and create
A little monarch of the rising state;
Then build wax-kingdoms for the infant prince,
And form a palace for his residence.

And Pliny observes,

*Apium enim coïtus visus est nunquam. Plures existimavere oportere
confici floribus compositis aptè atque utiliter*.*

At last however, that sagacious Enquirer Mr. de Reaumur, from whom nature can scarce conceal any thing, hath, in a great measure, removed the veil.

Mr. de Reaumur divided a great number of bees into *two hives*, of which the *one* had a queen, and the *other* had none. The queen did not at first appear to be much respected in her hive, but by degrees her subjects came to acknowledge her, to give her the royal retinue, to caress her, and to lick her with their proboscis, which is a pleasing and useful homage, as she is made more sleek by it, and her bronchiæ or stigmata are more opened for the air. Mr. de Reau-

* Swammerdam had a notion that the female was fecundated without any venereal congress; that it was sufficient for her to be near the males; that a vivifying aura exhaling from the body of the male, and snuffed up by the female, might impregnate her eggs.

mur judges with a great deal of probability, that the trouble and confusion, with which the separation of the two hives had been necessarily attended, was the cause of the little attention that had been paid to the queen at the first, when each thought of nothing but *himself*.

The two hives were very unequal in size, and unequally peopled by bees. The *small one* had four or five times fewer than the other, but it was *there* the queen resided. In this hive they began industriously to work on combs, yet in a little time it was deserted by several bees who chose to go and settle elsewhere, perhaps on this very account because they had a queen; they were sensible that this queen would be too prolific for the hive, which could not contain a sufficient number of cells for all her young.

On the other hand, the bees of the larger hive came to settle in the small one; which was grown unpeopled although the queen resided there, and they came thither in such crouds that not being able to enter *all* notwithstanding their utmost efforts, they heaped themselves on the outside in great clusters. Some subtil instinct had taught them that a queen was *there*, and some very urgent reason conducted them thither.

As this queen might be their mother, or at least their sister, one may attribute to them some particular affection for her, but Mr. de Reaumur hath been well assured that every queen is alike to them, and that they are attached, not to the *person*, but to the *dignity*, which is but too commonly true with regard to men.

The larger hive, in which there was no queen, had a fate far different from the small one. Scarce could the bees determine with themselves to go out and seek their sustenance in the fields, several of those that did go out disdained to return, no labour within, no waxen edifices or stores, they pined away, at last all died; and all this calamity for want of a queen, that is to say, if we may dare to surmise the thoughts of insects, for want of having hopes that a

numerous issue would survive them. The displeasure of being deprived of posterity went so far as to make them neglect life, which may appear perhaps heroical. It was evident that the *small hive* displeased very much, on account of its smallness, the bees that were lodged in it, yet *there* they built their combs and formed their works; for *there* a queen resided:

—*Rege incolumi mens omnibus una est:*
Ille operum custos.

His life unites them all, but when he dies
All in loud tumults and distractions rise;
They waste their honey, and their combs deface,
And wild confusion reigns in ev'ry place.

When an hive full of bees, amongst which there was a queen, was soaked * in water, Mr. de Reaumur observed, that as soon as the queen was the least revived, all the others, who were no more recovered than her, forgot themselves, and were employed on that important personage, contributing all in their power to restore her.

There is however some foundation to suspect *that heroic love* in bees, either for their queen or for their posterity, to be only at the bottom of a self-interestedness. It is of great moment to them to be, even in their life-time, a mighty people; the cold weather would destroy them, if their great numbers did not sufficiently warm the hive, and their numbers depend on the fruitfulness of the mother.

They proportion their work to the prolifickness of the mother. Mr. de Reaumur observed an hive, where they were at work on a few combs, and with little vigour. From whence this inactivity and dispiritedness so uncommon amongst bees? He saw the reason.

* The motions of bees being too lively and quick, to make the necessary observations; Mr. de Reaumur contrived a method, by half drowning them in a tub of water, to perceive distinctly the minutest circumstances, as they recovered slowly to life and motion.

of it when he got into his hands the mother of the hive, who was small and pitiful in comparison to other mothers. The rest judged of her as she deserved.

What is still more surprising is, that a cell, which was known by its size and shape to contain an egg from whence a mother naturally should be hatched, having been conveyed into another hive, which was designedly deprived of its mother, the bees of that hive immediately perceived that they had, at least, the hopes of a mother, and set themselves to work; but on the footing *alone* of hopes, and did not apply themselves to it with all their natural vivacity till the mother was born, who indeed appeared very likely to answer their expectations.

As the queen hath her title only because she is the mother of all the people, the bees are attached to her only as she is a mother, and not as she is a queen. They pay her a kind of filial duty, that is proportionate to her fertility and usefulness; if another queen comes into the same hive, they will respect her as much as the former, and easily suffer the royalty to be divided; they receive with pleasure the assurance of a more numerous posterity.

One would think that where multiplication is so honourable, the mysteries of love should not be very secret; yet how diligent soever the naturalists have been in peeping behind the curtain, they have never discovered the consummation of nuptial rites: even Mr. de Reaumur himself could see no more than to raise a jealousy, and to give strong suspicions. Having stood the fiery trial of so many prying eyes in every age, the bees had gained the character of an inviolable chastity; but Mr. de Reaumur hath, with *learned barbarity*, intirely blasted their reputation; he makes the queen no better than a Messalina*, or, to compare her to one of her own dignity, another Cleopatra. He put a drone and a female bee in private together, the drone appeared to be very cold and indifferent, and,

* Vid. Juvenal. Satyr. vi. ver. 128.

contrary

contrary to what one would expect, it was the female that made all the advances, a thousand tender careſſes—*The reſt I beg leave to give in the language of Ovid,*

*Pugnacemque tenet, luſtantiaque oſcula carpit,
Subjeſtatque manus, invitaque pectora tangit;
Et nunc hac juveni, nunc circumfunditur illac,
Denique nitentem contra, elabique volentem
Implicat, ut ſerpens, quam regia ſuſtinet ales.*

With tranſport faſtens on him as he ſtrives,
Clasps in her arms, and round his limbs ſhe writhes.
The more the boy reſiſted and was coy,
The more ſhe clasp'd, and kiſs'd the ſtruggling boy.
So when the wriggling ſnake is ſnatched on high,
In eagle's claws, and hiſſes in the ſky;
Around the foe his twirling tail he flings,
And twists her legs, and writhes about her wings.

The experiment was repeated and varied ſeveral times, but always the like coldneſs in the males, and the ſame ardour in the females. The adventure hath often a tragical end with reſpect to the males, they die, and one cannot aſſign any reaſon for it unleſs it be *for ſhame*.

How Mr. de Reaumur eſcaped having his eyes pulled out by the ladies in France I know not, but he ſaw and hath blabbed ſecrets of the queen in French, that I would not for the world tranſlate into Engliſh; that philoſophers however may not be angry with me for omitting a natural curioſity, I ſhall give the ſubſtance of what Mr. de Reaumur hath ſaid in one line of Horace,

Clunibus aut agitavit equum laſciva ſupinum.

The fertility of the mother bees, even ſuch as are the moſt teeming, is ſuſpended during winter, and moreover an hive always loſes a great number of its inhabitants, either by cold or by hunger. At the return of the ſpring the mother reſumes her employment of
laying

laying eggs, by virtue of an impregnation that she must have received six months before. The eggs of the bees therefore are not, as in the greater animals, destined by nature to be emitted *all* at a certain determinate and nearly equal time after their fecundation. They acquire the *maturity* that is necessary to them in very unequal times; probably they cease to acquire *any* during the whole winter.

By Mr. de Reaumur's calculation, a queen may lay two hundred eggs a day in the most favourable seasons, which may include more than an hundred days in the year. It is not surprising therefore that an hive should no longer be capable of containing both its ancient inhabitants and the new-born progeny; from thence great numbers are obliged to go forth and establish themselves elsewhere: this migration is called a *swarm*, and the hive is said to have *bred*. When a swarm, that seeks its fortune, goes to seize on a place already occupied by other bees, on an hive well peopled; it often finds a very vigorous resistance, and the great battles that are fought either by bees or men arise in general from such occasions.

A swarm doth not go out unless it hath a queen at its head,

——— *ducunt examina reges;*

The youthful bees, led by their monarch, shun
The crouded hive, and sport it in the sun.

This is so true, that Mr. de Reaumur having been surprised to find no swarm to issue from an hive so well peopled, that it must have become too thronged an habitation, and suspecting that the want of a queen was the cause of it, found in reality by soaking the whole hive in water, that a new colony could not have a commander to lead them, or more properly a mother to assure them of that posterity which they are so passionately fond of.

When you see the works carried on faintly in an hive, it is a mark that there will soon be a swarm. It seems as if the resolution had been taken in a general council of the nation, the day fixed, and that till then it was sufficient to supply the actual wants of life.

Four

Four or five days after a female is born, she is in a condition to be a queen and to command a swarm. As all her dignity consists in her fruitfulness, it is highly probable that she quits her *minority* as soon almost as she quits her nest, and makes herself capable of wearing the crown by the aid of the drones; for it doth not appear that any drones go forth with the swarms, at least they do not with all swarms.

It may happen that a swarm might be composed only of an entirely new generation, but that is not the constant rule; old and young bees go forth together in order to found a colony: you may distinguish their age, almost with certainty, by their colour alone; the old are more reddish. The queens themselves are in this respect like the others. Most commonly a swarm is conducted by a young queen. But it is possible that it may be led forth by two, or even by three. What will happen in that case? The reader perhaps would not have divined it, but it will cost their lives to the supernumerary queens; there will remain no more than *one*. Is it the common working bees that have destroyed the supernumerary sovereigns? Or hath there happened a combat between the rival queens? It is most probable that the first is the cause. The bees are desirous of posterity, it is their only wish, but then they would have it proportionate to their provision for them. A greater issue would occasion fatigue to themselves, and perhaps unhappiness to their offspring. They chuse rather to prevent these inconveniences by ridding themselves of some queens, whom they consider as made only for the common good, and that ought to be sacrificed to it when occasion requires.

The first fifteen days of the new establishment of a swarm in an hive are employed in the most active labour, there is sometimes as much work dispatched in that little time, as in all the rest of the season that is proper for working.

There may go forth three swarms from a single hive in one season; and there have been swarms that consisted of forty thousand bees.

An

An hive that is tended with the usual care must perish in the course of a few years by divers accidents happening to the bees. Mr. de Reaumur mentions an hive that was preserved for thirty years; the case must be rare; but nine or ten years might, with care, be very possible.

Virgil indeed says,

*Ergo ipsas quamvis angusti terminus ævi
Excipiat, (neque enim plus septima ducitur æstas)*

The narrow bounds of age they quickly run,
And the sev'nth year the thread of life is spun.

Yet Aristotle allows they may live to nine or ten years, and Columella expressly says,

Durantque, si diligenter excultæ sint, in annos decem.

And Pliny likewise observes,

*Alveos nunquam
Ultra decem annos durasse proditur.*

G

AN ACCOUNT OF BEES.

B O O K II.

C H A P. I.

Of the Apiary and Hives.

THE curious reader is now as much acquainted with the natural history of these useful and industrious insects the bees, as the limits of this work will admit of: for I propose to give only such an out-line of it as may excite the ingenious inquirer to pursue a study which will afford him much entertainment, now that he shall have the bees under that easy and constant command, of which the means shall be taught him in the following sheets; at the same time that it will throw much light on the various steps directed to be taken in the management of them, even to those who make profit their chief object. These have indeed been the motives of my learned and worthy friend who has favoured the public with that account.

In order to make the following instructions the more clear to the reader, I shall trace the several steps to be taken in the management of bees, through the various seasons of the year, beginning with spring, when the round of their operations may be said to begin. Previous to the entering on this detail, the choice of a situation favourable for their labours, not only as to the air, but also as to the quality and quantity of food, and ease and safety of coming at it, is a matter worthy of attention.

Principio sedes apibus statioque petenda.

A description of the habitations intended for them will next be proper, as well as the choice of proper inhabitants, supposing them to be purchased.

9
S E C T.

S E C T. I.

Of the situation of the apiary.

THE apiary should face between the south and west, in a place neither too hot, nor too much exposed to the cold; it should be so situate as that the bees returning home from their labours may descend to their hives; it should be near the mansion-house, on account of the conveniency of watching them. I have ever found it best to place the mouth of the hives to the west in spring, care being taken that they enjoy the afternoon sun; the morning sun is extremely dangerous during the colder months, when its glare often tempts these industrious insects out to their ruin; whereas the mouth of the hive being then in the shade, the bees remain at home, and as clouds generally obscure the afternoon's sun at that season, the bees escape the temptation of going out. When food is to be obtained, the warmth of the air round the hive continues in the afternoon, which strengthens the bees, and enables them to pursue their labours.

The hives should not be placed where the water from the eaves of houses, from trees or hedges, drop on them. A small stream of clear water running near them is thought to be of advantage, especially in hot countries, or in dry seasons, with gently declining banks, in order that the bees may have safe access to it. It appears from Columella *, that they found it necessary in Italy when there was no stream near, to have the water brought near them in troughs, with pebbles or small stones in the water, or rather pieces of wood, for the bees to rest on, whilst they drink; for water is so necessary for insects, that if flies are confined in a close room during a very few days in the summer, in which they have no access to moisture, they will all die: water may besides be of particular use to bees in working up their several materials, such as combs, honey, &c. However much these precautions are necessary in other countries, the natural moisture of our atmosphere, and of all our vegetable productions, on which our bees feed, renders

* Lib. ix. c. 5.

them very little necessary here. The near neighbourhood of large rivers or basons of water, with high banks, should be avoided, because winds may whirl the bees into them; and they cannot easily get on shore from thence to dry themselves.

The garden in which the apiary stands should be furnished with such plants as afford the bees plenty of good pasture; and the trees in it should be of the dwarf kind, with bushy heads, in order that the swarms which settle on them may be more easily hived.

The proprietor should be particularly attentive that the bees have also in their neighbourhood such plants as yield them plenty of food. Columella * enumerates many of these fitted to a warm climate: among them he mentions thyme, the oak, the pine, the sweet smelling cedar, and all fruit trees. Experience has taught us, that broom, mustard, clover, heath, &c. are excellent for this purpose. Pliny recommends broom, in particular, as a plant exceedingly grateful and very profitable to bees; and Mr. Bradley speaks so highly of the advantages which arise from the planting of it for the food of these useful insects, that I hope my readers will pardon the length of the following quotation from him.

“ Of the broom we have two sorts which will grow freely in
 “ England, viz. the common sort of the fields, and the Spanish
 “ broom, which till very late has been propagated and cultivated
 “ only in the gardens; but at present some gentlemen have raised
 “ it in their fields, by my advice; and though they could never
 “ before have any profit by bees, they are now masters of weighty
 “ stocks; and also have begun to find the good effect of these plants
 “ for binding and working of baskets, for they produce long and
 “ tough withs, not to be worn or broken like withs of willows or
 “ osiers. The bloom or flower of this sort is also very beautiful and
 “ sweet, perfuming the air like orange-flowers in May, which invite
 “ the bees and enrich them very greatly, so that their hives are full
 “ betimes in the summer. And considering the profit of honey and
 “ wax, when bees prosper, I think that whatever ground happens to

* Lib. xxi. c. 12.

“ be planted with such flowering plants, as give them a large share
 “ of nourishment, and afford them plenty of wax and honey, may
 “ be said to be valuable: for from the observations I have made of
 “ bees, and the manner of gathering their honey, one may reason-
 “ ably conjecture, that an acre of ground which is cultivated with
 “ so rich a flower-shrub, will bring such a return as will pay the
 “ rent; provided the neighbouring parts do not keep many bees, to
 “ rob our own stocks; for by a calculation, which one may justly
 “ enough make on the bees account, one may conclude, that an
 “ acre of Spanish broom will afford wax and honey enough for ten
 “ good stocks of bees: for this broom brings a vast quantity of
 “ flowers fertile both in honey and wax, and continues blowing a
 “ long time. And when a stock of bees have flowers to their lik-
 “ ing, of which this is one of the chief, and have a large quantity
 “ of them, they will fill their hive both with wax and honey, in
 “ five or six weeks, if the weather will permit them to go abroad;
 “ but this hazard is no more than other crops are subject to, the
 “ weather having the management of all crops, either for their
 “ well or ill fare. The common broom is no way comparable to
 “ the Spanish broom, either for its flowers, or its withs.”

The Abbé *Boissier de Sauvages* having discovered a substance not
 before attended to, which the bees collect and turn to honey; I
 shall here give the purport of what he says in a memoir read before
 the Society of Sciences at *Montpellier*, on the 16th of *December* 1762,
 on the origin of honey*.

He begins with declaring it to be his opinion, that the bees have
 no other share in the making of honey, than simply collecting it.
 Other writers believe, that when the liquor which the bees collect has
 been for some time in their stomachs, it comes from thence changed
 into true honey; the liquor having been there properly digested
 and rendered thicker than when it entered. The Abbé *Boissier's*

* Observations sur l'Origine du Miel, par M. L'Abbé Boissier de Sauvages, à
 Nîmes, 1763.

opinion is supported by the honey's being still a body subject to vinous fermentation when properly diluted, which does not obtain in any animal substance that I know of.

Besides the liquor already mentioned, which is obtained from the flowers of plants, the Abbé acquaints us, that he has seen two kinds of honey-dews, which the bees are equally fond of: both derive their origin from vegetables, though in different ways.

The first kind, the only one known to husbandmen, and which passes for a dew that falls on trees, is no other than a mild sweet juice, which, having circulated through the vessels of vegetables, is separated in proper reservoirs in the flowers, or on the leaves, where it is properly called the honey-dew: sometimes it is deposited in the pith, as in the sugar-cane, and at other times in the juice of pulpy summer fruits, when ripe. Such is the origin of the manna which is collected on the ash and maple of *Calabria* and *Briançon*, where it flows in great plenty from the leaves and trunks of these trees, and thickens into the form in which it is usually seen.

“Chance,” says the Abbé *Boissier*, “afforded me an opportunity of seeing this juice in its primitive form on the leaves of the holm-oak: these leaves were covered with thousands of small round globules or drops, which, without touching one another, seemed to point out the pore from whence each of them had proceeded. My taste informed me that they were as sweet as honey: the honey-dew on a neighbouring bramble did not resemble the former, the drops having run together; owing either to the moisture of the air, which had diluted them, or to the heat, which had expanded them. The dew was become more viscous, and lay in larger drops, or, plaster-wise, covering the leaves. This is the form that it is usually seen in.

“The oak had at this time two kinds of leaves; the old, which were strong and firm, and the new, which were tender and lately
“come

“ come forth. The honey-dew was found only on the old leaves,
 “ though these were covered by the new ones, and by that means
 “ sheltered from any moisture that could fall from above. I ob-
 “ served the same on the old leaves of the bramble, while the
 “ new leaves were quite free of it. Another proof that this
 “ dew proceeds from the leaves is, that other neighbouring trees
 “ which do not afford a juice of this kind, had no moisture on
 “ them; and particularly the mulberry, which is a very happy cir-
 “ cumstance, for this juice is a deadly poison to silk-worms. If
 “ this juice fell in the form of a dew, mist, or fog, it would wet all
 “ the leaves without distinction, and every part of the leaves, under
 “ as well as upper. Heat may have some share in its production:
 “ for though the common heat promotes only the transpiration of
 “ the more volatile and fluid juices; a sultry heat, especially if re-
 “ flected by clouds, may so far dilate the vessels, as to bring forth a
 “ thicker and more viscous juice, such as the honey-dew.

“ The second kind of honey-dew, which is the chief resource of
 “ bees after the spring flowers and dew by transpiration on leaves
 “ are past, owes its origin to a small mean insect, the excrement
 “ thrown out by which, makes a part of the most delicate honey
 “ we ever taste *.

“ These vine-freeters rest during several months on the bark of
 “ particular trees, and extract their food by piercing that bark, with-
 “ out hurting the tree, or bringing upon it any deformity; as do
 “ those insects which make the leaves of some trees curl up, or
 “ cause galls to grow upon others. They settle on branches which
 “ are a year old. The juice, at first perhaps hard and crabbed,
 “ becomes, in the bowels of this insect, equal in sweetness to the
 “ honey obtained from the flowers and leaves of vegetables; ex-
 “ cepting that the flowers may communicate some of their essential

* The French call this insect a *Puceron*. It is a kind of vine-freter.

“ oil to the honey, and that this may give it a peculiar flavour; as
 “ happened to myself, by planting a hedge of rosemary near my
 “ bees at *Sauvages*, the honey has tasted of it ever since; that
 “ shrub continuing long in flower.

“ I have observed two species of vine-freeters which live unsheltered
 “ on the bark of young branches: they have a smooth skin, and those
 “ without wings seem to be the females, which make the great
 “ bulk of the swarm; or perhaps the young in their caterpillar
 “ state, before they are changed into flies; for each swarm has in
 “ its train two or three males with wings: these live on the labours
 “ of the females, at least I always saw them hopping carelessly on
 “ the backs of the females, without going to the bark to seek for
 “ food.

“ Both species live in groups on different parts of the same tree.
 “ They there stick close to one another around the branch, entirely
 “ covering the bark; and it is remarkable that they there take a
 “ position which may seem to us to be a very uneasy one; for they
 “ adhere to the branch with their head downward, and their belly
 “ uppermost.

“ The lesser species is of the colour of the bark on which it feeds,
 “ and that is generally green. It is chiefly distinguished by two
 “ horns, or strait immoveable fleshy substances, which rise perpen-
 “ dicular from the lower sides of the belly, one on each side.
 “ This is the species which lives on the young shoots of brambles and
 “ of elder.

“ The former of these species is double the size of this last, and
 “ is that which I now have most particularly in view, because it is
 “ that from which the honey comes. These insects are blackish,
 “ and instead of the kind of horns which distinguish the others,
 “ they have, in the same part of the skin, a small button, black
 “ and shining like jet.

“ The

“ The buzzing of bees in a tuft of French or holm oak, made
“ me suspect that some very interested view brought so many of
“ them thither. I knew that it was not the season for expecting
“ honey-dew, nor such the place where it usually is, and was sur-
“ prized to find in the centre of the tuft leaves and branches
“ covered with drops which the bees collected with a humming
“ noise. The form of the drops drew my attention, and led to the
“ following discovery. Instead of being round, like drops which
“ had fallen, each of these formed a little longish oval. I soon
“ perceived from whence they proceeded. The honeyed leaves were
“ situated beneath a swarm of the larger black vine-freeters; and on
“ observing these insects, I saw them from time to time raise their
“ bellies, at the extremity of which there then appeared a transpa-
“ rent amber coloured drop, which they instantly darted from them
“ to the distance of some inches. I found, on tasting some which
“ I had caught on my hand, that it had the same flavour with
“ what had before fallen on the leaves. I afterwards saw the
“ smaller kind dart their drops in the same manner.

“ This darting, to which the drop owes its oval form, is not a
“ matter of indifference to these insects themselves, but seems to
“ have been wisely instituted in order to preserve cleanliness in each
“ individual, as well as among the whole swarm: for, pressing as
“ they do one upon another, they would otherwise soon be glued
“ together, and rendered incapable of stirring.

“ We may now, with some probability, account for the seem-
“ ingly odd situation in which they rest. Their belly is about
“ twenty times larger than their head and breast. If the insect
“ was placed in a contrary direction, it could not, without extreme
“ difficulty, raise its heavy belly, so as to project it outward, suffi-
“ ciently to discharge the drop over its companions; whereas, when
“ its head is lowermost, much less effort is requisite to incline it
“ forward; and even in this situation the insect seems by its flutter-
“ ing to collect all its strength. When the winter's cold and rains

“ come on, these vine-freeters place themselves wherever they are least
“ exposed; and as they then take but little nourishment, and but
“ seldom emit their drop, they seem not to mind whether the head
“ or tail be uppermost.

“ The drops thus spurted out fall upon the ground, if leaves or
“ branches do not intervene; and the spots which they make on
“ stones remain long, unless they are washed off by rain. This is
“ the only honey-dew that falls; and this never falls from a greater
“ height than a branch on which these insects can cluster.

“ It now is easy to account for a phenomenon which formerly
“ puzzled me much. Walking under a lime tree in the king's gar-
“ den at *Paris*, I felt my hands wetted with little drops, which I
“ at first took for small rain. The tree should have sheltered me
“ from rain, but I escaped it by going from under the tree. A feat
“ placed by the tree shone with these drops. Being then unacquainted
“ with any thing of this kind, except the honey-dew which is
“ found upon leaves, I was at a loss to conceive how so glutinous
“ a substance could fall from the leaves in such small drops; for I
“ knew that rain could not overcome its natural adherence to the
“ leaves, till it became pretty large drops: but I have since found,
“ that the lime tree is very subject to these insects.

“ Bees are not the only insects which feast on this honey. Ants
“ are equally fond of it. Led into this opinion by what naturalists
“ have said, I at first believed that the horns in the lesser species
“ of these vine-freeters, had at their extremity a liquor which the
“ ants went in search of: but I soon discovered, that what drew the
“ ants after them came from elsewhere, both in the larger and the
“ lesser species, and that no liquor is discharged by the horns.

“ There are two species of ants which search for these insects.
“ The larger black ants follow those which live on the oak and
“ chestnut: the lesser ants attend those of the elder. As the ants
“ are

“ are not provided with the means of sucking up fluids, they place
 “ themselves near the vine-freeters, in order to seize the drop the mo-
 “ ment they see it appear on the anus : and as the drop remains some
 “ time on the small vine-freeters, before they can dart it off, the ants
 “ have leisure to catch it, and thereby prevent the bees from having
 “ any share of it : but the vine-freeters of the oak and chefnut being
 “ stronger, and perhaps more plentifully supplied with juice, dart
 “ the drop instantly, so that the larger ants get very little of it.

“ The vine-freeters finding the greatest plenty of juice in trees in the
 “ middle of the summer, afford also at that time the greatest quan-
 “ tity of honey; and this lessens as the season advances, so that, in
 “ the autumn, the bees prefer to it the flowers then in season.

“ Though these insects pierce the trees to the sap, in a thousand
 “ places, yet the trees do not seem to suffer at all from them, nor
 “ do the leaves lose the least of their verdure. The husbandman
 “ acts therefore injudiciously when he destroys them.”

In Kempen-land in Germany, I have seen, says Worlidge *, about
 forty great bee-hives, which contain, when they are full, about
 seventy pound weight in honey, placed near a great field, sown
 with buckwheat; and it was related to me of a truth by the inha-
 bitants, that the bees did suck such plenty of honey out of it, that in
 a fortnight's time the said hives were filled therewith.

* Mystery of
 Husbandry,
 chap. ix. § 3.

All the willows which bear an early bloom, gooseberries, &c.
 are of great use to bees, for closing the combs in which their young
 brood is laid on the first approach of spring. Turneps in bloom
 and other early plants come in very seasonably both for food and
 wax, at a time when their winter stock may have been nearly ex-
 hausted. Mustard is attended with this advantage, that by sowing
 the seed at different times, the bloom may be continued during some
 weeks.

Though bees collect good honey from most herbs and flowers,
 yet as by the following fact it is evident, that they may collect from

poisonous plants, honey which may be noxious in its effects, equal care should be taken in removing the plants which afford such juices, as is taken to collect plants of a contrary quality.

Xenophon mentions in the famous retreat of the ten thousand, " that the soldiers sucked some honey-combs in a place near Trebizonde where there was a great number of bee-hives, that all who sucked them became intoxicated, vomited, and purged; not one was able to stand upon his legs, those, who had taken but little, were like men drunk, but those, who had taken a good deal, were like men mad, and some lay like men dead: the next day about the same hour they recovered their senses, but it was three or four days before they were entirely restored, as if they had taken a poison." This fact cannot be a romance from so grave a writer, who was present and for a considerable time had the principal command. Mr. Tournefort in his travels through this country was particularly attentive to this account of Xenophon, and observes that the chamærhododendros pontica, maxima, mespili folio, flore luteo, which grows commonly in the neighbourhood of Trebizonde, hath these effects, and that even its smell affects the head; he judges therefore that the honey had been extracted by the bees from the chamærhododendros, and adds, that father Lamberti, a missionary, observes, that the honey which bees gather from a certain shrub of Colchis or Mingrelia, is dangerous, and causes vomiting; from the description Mr. Lamberti hath given of the shrub, Mr. Tournefort pronounces it to be the chamærhododendros, mespili folio; its smell very much resembles the honey-suckle's, but is much stronger.

SECTION II.

Of Hives.

STRAW hives, as far as regards the bees, are preferable to any other habitations, because the straw is not so liable to be heated by the rays of the sun at noon, to which they are generally exposed, and is a better security against the cold than any kind of wood or other material.

material. Their cheapness renders them of an easy purchase, even to the cottager, which is of great advantage in an article, the production of which in a considerable quantity depends on its being cultivated by the multitude, as must be the case here, if a quantity of wax is collected sufficient to make it an object of utility in a commercial view. I might also have mentioned the greater quantity of honey produced: for when it is obtained in the plenty, I flatter myself the instructions given in this work will enable men to do; they will then have in their own hands a material which will yield them wine, in flavour equal to many imported, and in wholesomeness much superior.

As I propose that the management of bees in hives shall be altered from what is now practised, so the size and form of my hives are different from those now in common use. I say, *now*, because I take to myself some share of honour, that without any communication with the Count de la Bourdonnaye in Britany, nearly the same thought has occurred to us both.

My hives are seven inches in height, and ten in width. The sides are upright, so that the top and bottom are of the same diameter. A hive holds nearly a peck. In the upper row of straw there is a hoop of about half an inch in breadth, to which are nailed five bars of deal, full a quarter of an inch in thickness, and an inch and quarter wide, and half an inch asunder from one another; a narrow short bar is nailed at each side, half an inch distant from the bars next them, in order to fill up the remaining part of the circle: so that there are in all seven bars of deal, to which the bees fix their combs. The space of half an inch between the bars allows a sufficient and easy passage for the bees from one hive to another. In order to give greater steadiness to the combs, so that upon moving the hive, the combs may not fall off, or incline out of their direction, a stick should be run through the middle of the hive, in a direction directly across the bars, or at right angles with them.

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When the hives are made, a piece of wood should be worked into the lower row of straw, long enough to allow of a door for the bees of four inches in length, and half an inch in height.

The proprietor of the bees should provide himself in several flat covers of straw, worked of the same thickness as the hives, and a foot in diameter, that so it may be of the same width as the outside of the hives. Before the cover is applied to the hive, a piece of clean paper of the size of the top of the hive should be laid over it, and a coat of cow-dung, which is the least apt to crack of any cement easily obtained, should be laid all round the circumference of the hive. Let the cover be laid upon this, and made fast to the hive with a packing-needle and pack-thread, so that neither cold nor vermin may enter.

Each hive should stand single on a piece of deal, or other wood, somewhat larger than the bottom of the hive: that part of the stand which is at the mouth of the hive, should project some inches for the bees to rest on when they return from the field. This stand should be supported upon a single post, two and a half feet high; to which it should be screwed very securely, that high winds or other accidents may not blow down both stand and hive. A quantity of foot mixed with barley-chaff should be strowed on the ground round the post, which will effectually prevent ants, slugs, and other vermin from rising up to the hive. The foot and chaff should from time to time be renewed as it is blown or washed away: though as it is sheltered by the stand, it remains a considerable time, especially if care be taken that no weeds rise through it. Weeds indeed should not be permitted to rise near the hive, for they may give shelter to vermin which may be hurtful to the bees.

The stands for bees should be four yards asunder; or if the apiary will not admit of so much, as far asunder as may be, that the bees of one hive may not interfere with those of another hive, as is sometimes the case, when the hives are seated near one another, or on
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the same stand: for the bees mistaking their own hives, light sometimes at the wrong door, and a fray ensues, in which one or more may lose their lives.

The person who intends to erect an apiary, should purchase a proper number of hives at the latter end of the year, when they are cheapest. The hives should be full of combs, and well stored with bees. The purchaser should examine the combs, in order to know the age of the hives. The combs of that season are white, those of a former year are of a darkish yellow: and where the combs are black the hives should be rejected, because old hives are most liable to vermin and other accidents.

If the number of hives wanted were not purchased in the autumn, it will be necessary to remedy this neglect after the severity of the cold is past in the spring. At this season, bees which are in good condition will get into the fields early in the morning, return loaded, enter boldly, and do not come out of the hive in bad weather; for when they do, this indicates that they are in great want of provisions. They are alert on the least disturbance; and by the loudness of their humming we judge of their strength. They preserve their hives free from all filth, and are ready to defend it against every enemy that approaches.

The summer is an improper time for buying bees, because the heat of the weather softens the wax, and thereby renders the combs liable to break, if they are not very well secured. The honey too being then thinner than at other times, is more apt to run out at the cells, which is attended with a double disadvantage, namely, the loss of the honey, and the daubing of the bees, whereby many of them may be destroyed. A first and strong swarm may indeed be purchased; and if leave can be obtained, permitted to stand in the same garden till the autumn; but if leave is not obtained, it may be carried away in the night after it has been hived.

I suppose

I suppose that in the stocks purchased, the bees are in hives of the old construction. The only direction here necessary is, that the first swarm from these stocks should be put into one of my hives; and that another of my hives should in a few days be put under the old stock, in order to prevent its swarming again. As this matter will be fully treated of in the next chapter, I refer the reader to it.

After an account of my own hives, I shall subjoin the Count de la Bourdonnaye's improvement on hives, as related by the society established by the States of Britany for the improvement of agriculture, arts and commerce, who have been constantly distinguished by the regularity and judgment which attend all their steps. They have proceeded admirably in regard to bees*. They began with procuring information of what has been hitherto done to preserve the lives of those useful creatures, and at the same time increase the quantity of wax, their principal object. Count de la Bourdonnaye took upon himself not only the making of this inquiry, but also the conducting of such experiments as might be necessary to ascertain the true merit of each method proposed.

In their Memoirs for the year 1759 and 1760, we are informed†, that the Count preferred the following, on account of the success with which it was attended, and also for its cheapness, which, as they justly observe, is a most important point in whatever relates to the management of rural affairs.

Count de la Bourdonnaye's hives are made of straw, divided into two parts, which are placed one over the other. Each of these parts is twelve Paris inches‡ in diameter in the inside, and eleven inches high; so that, when joined, they make an hive twenty-two inches in height. They are nearly flat on the top, and have in the

* Corps d'Observations de la Société d'Agriculture, de Commerce, et des Arts, établie par les Etats de Bretagne. Années 1757 et 1759, p. 162.

† P. 237.

‡ The Paris foot is to the English foot, as $12\frac{7}{10}$ inches are to 12 inches.

middle of the top a hole an inch and a quarter square. The upper half rests on the lower. They are made of sufficient thickness to be proof against cold, and not to be heated by the rays of the sun. When united, their joining is luted close.

SECTION III.

Of Boxes.

HOWEVER much hives may exceed boxes in real utility, yet many prefer boxes, both as more ornamental to the eye, and as by means of windows made in them, they afford entertainment by seeing something of the progress made within. With this view glass-hives have been also made use of; but it has been found that they give so little real information, and are found so little agreeable to bees, that they are now generally laid aside.

Mr. Hartlib in his *Commonwealth of Bees* mentions an experiment of *glassen-hives* invented by Mr. William Mew, minister of Eastington in Gloucestershire: and in the same book gives a description of a bee-hive made of boards of an octagon form, with a glass-window on the back-side of it, for the observation of their works. Soon after this John Geddy, Esq; published a further account of boxes for bees. Joseph Warder, physician at Croyden, made considerable improvements on the boxes, and added several curious circumstances concerning bees in his work intituled, *The true Amazons, or the Monarchy of Bees*. The Reverend Mr. John Thorley of Oxford, in his *Inquiry into the Nature, Order and Government of Bees*, added but little of real utility to Dr. Warder, except the use of his Narcotic, which, I flatter myself, will now be very little wanted.

The Reverend Mr. Stephen White, rector of Holton in Suffolk, in his *Collateral Bee-boxes, or an easy and advantageous Method of managing Bees*, has attempted a new improvement, by having his

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boxes

boxes on the *a* level: but it has been found that the bees lay their eggs promiscuously in both boxes, and that therefore these boxes do not fully answer the design they were intended for. It is needless to say more of the improvements made by these gentlemen, because their works are in every one's hands, who may compare their methods with mine, and follow what shall appear to them the best.

A very ingenious Lady in Swisserland, and extremely attentive to every circumstance relating to bees, has entered into the same view with Mr. White, of making what may be called collateral boxes of a simple and seemingly convenient structure. As I think her boxes and observations well worthy the public eye, I shall give her description and uses of her boxes, as related in the *Memoires et Observations recueillies par la Societé Oeconomique de Berne, Année 1764*, part I. p. 95. The article is termed, *Observations sur les Abeilles, par Madame Vicat née de Curtas, Epouse de M. Vicat, Professeur en Droit a Lausanne*. I am not a little proud of the similarity in our views.

She tells us, that she has always been of opinion, that the cells intended for breeding the young are placed in the centre of the hive. The hive is both drier and warmer there than in any other part. The moisture which flies upwards might be prejudicial to the young. The method which the bees observe in laying up their honey confirms this opinion. The centre is the last part filled, after the young broods are all become bees; and this honey is the first consumed, probably to make room for the queen's laying her eggs in those cells in the spring. This is much more likely, than that the bees should eat that part first, because it would putrify if kept. The queen begins early in the spring to lay her eggs, and she lays great numbers of them. M. de Reaumur says, that she lays two hundred eggs in twenty-four hours, and that six thousand bees are brought to perfection in the space of three weeks. On this principle Madam Vicat has contrived her boxes, so that these cells, so much wanted in the spring, shall not be taken away.

She places her boxes on a stool, or rather table, of fir; for oak, being a more solid wood, is colder, and thereby the bees, which either fall or rest upon it in the winter, may be so chilled as not to be able to rise again. This table is three feet long, fifteen inches in breadth, and three inches thick. It slopes on the sides, which gives the middle an elevation that keeps it dry in rainy weather. There run along each side two grooves, the innermost to receive the boxes, and the other, which is deeper, to receive the cover. In the middle of the table is a hole eight inches square, which is closed with a slider, supported underneath by grooves cut in the solid wood. There is in the slider a hole four inches square; and this hole is covered with a plate of tin pierced with little holes, like the nozzle of a watering-pot, in order to admit air in hot weather. For the winter, and for the cold nights in spring and autumn, there is a slider of solid fir, which keeps out the air. The table is rested upon four strong feet, high enough to admit of examining the state of the bees from below. That the bees may have a convenient landing place before the hive, the table is extended some inches forward beyond the cover, and terminates there in a semicircle.

The hive or colony is composed of four boxes, if I may be allowed this expression, where there are only three sides. It may consist of three or of two boxes, as may be most agreeable to the owner. Each of the boxes is made of three pieces of deal, a full half inch thick. The two standing pieces are each eleven inches in height, and five and a half in breadth, and are dove-tailed into the piece at top, which sets the two standards at the distance of seven inches from each other above, whilst they are ten inches asunder at the bottom. They are kept thus distant by a rod, or thin piece of wood, which at the same time renders the box the stronger. This rod is placed within two inches of the bottom; and another is made to cross about an inch from the top, in order to afford a prop or stay to the combs. These boxes are not jointed or set into each other. They are only set quite close together; so that any one

of them may be easily separated from the rest of the colony. They are connected by rods of wood which run along the whole colony, and pass through wooden rings fixed to each side of each box. Each of these wooden rods has a hole in the end next the back of the colony, fit to receive a large iron wire, which after being passed through the holes, is drawn tight, to secure the piece of deal which forms the back of the colony. The piece which forms the fore-part of the colony is secured by two nuts screwed on to the ends of the wooden rods which come to the fore-part of the colony. By these means the boxes are kept very close together. The pieces of deal at each extremity of the colony or hive are exactly fitted to the boxes, so as not to exceed them in any part. These pieces being placed only at the extremities of the hives, when any part is taken away, what remains may be slid or pushed forward or backward in the grooves, and the extremities be immediately fitted thereto. There is in the middle of the end-pieces an opening, that in the front to give an outlet to the bees, that in the rear to be usually shut up. Three of these boxes hold as much as an ordinary straw hive: but the addition is not too much for a strong stock of bees.

There is on the table, as already mentioned, an outer groove to receive the cover of the boxes, which is made of fir, above half an inch thick. On one side it is thirteen inches high, and on the other seventeen; so that there may be a declivity sufficient to carry off the rain water. There is in the fore-part of it an opening, answering to the opening in the hive, to admit the bees. To this opening in the cover a frame is fixed, either on a pivot, or in a groove, and there are in it four partitions, to be either turned on the pivot, or moved in the groove, as occasion requires. The first partition gives a free passage to the bees, and is applied to the mouth of the cover in the working or swarming season: the next narrows the passage so that but few bees can get out or in at a time, and is used when there is danger of robbers: the third is pierced full of holes to let in air, whilst it confines the bees, and is used chiefly in the beginning
and

and end of winter: the fourth is intirely shut, and is applied when the weather is extremely cold.

It will be convenient to have panes of glafs in the fides of the boxes: and a hole to be opened occasionally at top, through which a thermometer may be introduced whenever it is thought proper.

When one of these hives or colonies is first peopled, the upper piece or top of one of the boxes is taken off, and the straw hive is placed upon the opening, putting a grate of wire in the hole, to prevent an union of the combs in the box with those in the hive, which would render the separation more difficult.

In the month of October, the first and fourth boxes, counting from the entrance, may be taken away; and this at a time when we are sure of not taking away any of the young brood; nor, as we have just observed, any of the cells appropriated for them, these being in the middle of the hive. When a box is to be taken away, the rod which holds the boxes firmly connected is unscrewed. The boxes which are to remain untouched may be secured by staples. The opening in the bottom of the piece of deal which forms the back part of the hive is then to be opened, and the smoke of linen rags is blown into the box. As soon as we can judge that the bees are by this means driven out of the farther box, the end is loosened and taken away; then the box itself is loosened from the next, and the combs, if they run in a longitudinal direction, must be cut through with a wire, or a sharp thin knife. If the combs run cross-wise, they may be taken out singly, before the box is taken away. The box being then removed, the piece of deal forming the back of the hive is immediately joined to the remaining box, and secured as it was before. The smoke should be kept up all the time, to prevent interruption from the bees. If the first box is to be taken away, exactly the same steps are to be pursued; and if it be done when most of the bees are abroad, scarce a bee will be lost.

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As soon as both boxes are taken away, the remaining boxes should be flipped forward, so as to make the front stand where it did before; and when the additional boxes are added in the spring, the two remaining boxes are pushed to the farther end. If the season is favourable, both the old boxes may be taken away in the summer.

In this method, no void space is left in the hives, and consequently the bees are not thereby exposed to so great a degree of cold as might endanger great numbers of their lives. We should, on this account, avoid adding an empty box whilst the nights continue cold in the spring. With proper care, the bees increase as fast in these colonies, as in any hives; and if swarms are wanted, it is but delaying the addition of empty boxes in the spring. This far M. Vicat.

In the construction of my boxes, I have in view the advantages proposed by the authors who formerly recommended boxes, namely ornament, and facility of taking honey and wax. In regard to the latter, I hope my small square boxes, Fig. 1. will be found superior to them; as they will also be at least equal to them in the entertainment they afford by means of their windows. I intend the larger box, Fig. 3. to answer the purpose of glass-hives, which it will exceed: for in it not only all the labouring bees, but also the queen may be in view as often as the proprietor pleases.

The double square box, Fig. 1. Plate II. made to part in two, is eighteen and a half inches high, and ten inches square. It consists of a frame, with doors *a a* on three of the sides, the fore part having a fixed cover. The upper box has a cover *b*, moving on hinges, and secured in the fore-part with a lock. The sliding frames, Fig. 2. *c c*, in which the bees make their combs, are three and a quarter inches thick, eight inches wide, and eight and a half in depth. Each of these frames have four slides *d*, Fig. 1. inch wide, and half an inch asunder; intended to prevent the bees extending their combs to the glass, which would render the taking them out
their

inconvenient. There is an upright partition *e* in the middle, to strengthen the frame, in the middle of which there is a division of half an inch, to afford an easy passage to the bees; and two similar passages in the bottom to give a free passage to the bees to go from one box to another: for this box stands on a lower box, which, instead of sliders to contain the combs, has six bars, to which the bees fix the combs in the lower box. The two boxes are fixed together by means of a hasp. The lower box has three doors, as the upper one; and the doors in each have a pane of glass fixed in them, with small brads, which are easily drawn out, when there is occasion to take out the panes of glass. Between the upper and lower boxes there is a slider *f*, which is put in when the frames with the combs are taken out of the upper boxes, or when the upper box is changed. A like slider *g* is put in the bottom.

The box, Fig. 3. consists properly of three boxes moving upon hinges, and when brought together is secured by hooks and eyes. When united, they are twenty-two inches in height, eighteen in thickness, and twelve in width; and make the appearance of one of the division of Fig. 3. These boxes are divided into two separate apartments for bees, *a*, *b*. In the upper apartment there is a frame constructed in the same manner, and for the same purposes as in the other boxes. In each apartment there are two glasses covered with doors *c c*, to keep out the glare of light, when they are extended. Each of these boxes have a cover *d*, sliding in a groove, to be taken out, when the frame with the combs is taken up. There is in these boxes, as the former, a slider *e* which goes in a groove between the upper and lower apartments; and also a like slider *f* in the bottom, in order to clear the hive of dead bees, or any other filth which may annoy them. Each box has an opening or door, *g g g* half an inch in height, and four inches in length at the bottom, and in the division which separates the boxes, in order to give the bees the easier passage to and from the fields, for carrying on their labours. Before
every

every door, whether in an extended or collected state, there should be a semicircular landing board placed before each door, having two pieces of wire in them, corresponding to holes in the boxes, for fixing them in their places. The tops of the boxes *b b b*, may be formed in any manner agreeable to the owner.

That the description of my instruments may come together, I shall add here an instrument very proper for feeding bees.

Honey is so penetrating a substance that no joining will contain it; and therefore a vessel, Fig. 4. should be turned out of the solid wood, in which honey is put in order to feed bees, when it is found necessary. The vessel *a* may be nine inches in diameter, and two and a half inches deep. On one side a piece is cut out to admit a vessel *b* four inches in breadth, and one inch clear of the turned vessel in length, the opening for the bees to pass from the hive to the honey, half an inch in height. The cover should be turned out of the same wood, and secured by a rabbit *c*, which enters a groove in the lid. In the middle of the cover, a hole *d* is made, in order to see when the honey is eat up, in which is a pane of glass, with a cover fitted to it, of the dimensions of the hole.

The boxes and all parts of them are made of red cedar, the fragrance of which is agreeable to the bees, besides that it is the warmest and driest of any wood.

Fig. 5. represents one of my straw hives.

CHAP. II.

Of swarming.

IT has been already observed, that the queen begins to lay her eggs so soon as the severity of the winter's frost is past, and proceeds in proportion to the mildness of the season. The number of young bees that may by this means rise in the hive may endanger the lives of all the bees by famine; an accident not sufficiently attended to; and yet when pointed out appears self-evident: for if the weather comes in mild in January, or even so late as February, so that the queen is induced to lay many eggs, they in due time become bees; and the increased multitude consume a great deal of honey. If this mild weather is succeeded by cold, rainy, or even dry weather, a famine may ensue in the hive, when the badness of the weather prevents the possibility of supply: for during even the cold dry weather, what flowers come forth or open, are found to have none of that sweet juice in them which constitutes honey. Dry days tempt bees to go out, when the cold and fatigue destroys many. On this account the proprietor should examine frequently into the state of his hives at this season, that if necessary, he may give them a proper supply, in which he should rather be bountiful than otherwise, because they are faithful stewards, and will return with interest what is thus in their so great need bestowed upon them. The manner of feeding them will be directed hereafter. It is from this cause that many hives die so late as May: and the owner is surprised what could have destroyed a hive which he had observed in a thriving state some time before, little suspecting that the number of bees which he was pleased to see, added to his own neglect, have been the cause of his loss. He is not to judge of the state of the hive by its weight at this time, because the number of young bees or maggots in it weigh heavy, and may impose on the unwary for real wealth.

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When a hive is become too much crouded by the addition of the young brood, a part of the bees think of finding themselves a more commodious habitation; and with this view single out a queen with whom they take wing. This is called swarming, and happens earlier or later, as the season has been more or less kindly. If the spring is mild, calm, and an early bloom is come on, then the swarms will be early and strong: but if it proves cold and windy with either rainy or dry weather, then will there be but few swarms, and those also very backward.

When the bees are thus crouded, and the weather is warm and calm, they delight to rise, especially after a sudden shower or a dark cloud has sent them home in crouds. They seldom swarm before the sun has warmed the air, that is, not before ten in the morning, and seldom later than three in the afternoon. We may know that their swarming approaches, if the hive appears so full of bees, that part of them hang in clusters on the outside; and the drones are perceived in greater numbers than usual, especially in the afternoon. But the most certain sign, and which indicates the event to be on that day, is, that the bees refrain from flying into the fields, though the season seems inviting. Just before they take their flight, there is an uncommon silence in the hive, and this continues for some time, or as long as the bees which are going out take up in filling their stomachs with honey, to be a stove in case of bad weather; but as soon as one breaks forth, they all follow, and are instantly on the wing.

For three or four nights before a swarm fallies forth, there is in the hive a peculiar humming noise, of which authors give very different descriptions, probably owing to the strength of imagination in each. Every sound among bees arises from their striking their wings against the air: their wings being their sole organ of voice, if I may be allowed the expression. By moving their wings more

or

or less forcibly and swiftly, they beat the air, and form the varied and confused sounds which we call humming. The noise which foretells their swarming is easily distinguished by those who are accustomed to it, and is more especially observed before the casts, or second and following swarms. The reason that this noise is less frequent before the first swarm is, that the young queen is not yet in a condition to go out with the new swarm; and therefore the seeming contest between the queens is not heard; in this case the old queen leads forth the swarm. They sometimes swarm, if much crowded, even before the young queen is come out of her cell; for the bees go on cheerfully in their labours, while they have the expectation of her coming forth. If their swarming is delayed for some days by rain, and the young queen is become strong enough to take wing, the swarm generally chuse the young queen for their leader; and with this view, she lies in the bottom of the hive, ready to fly off with them. The noise that is heard before the second and following swarms is owing to there being now two queens ready to sally forth, and a contest seems to arise which of them shall go. The old queen is seated in the crown of the hive, and the other near the bottom, and make reciprocal answers to one another. The distance whence the sound comes, probably constitutes the difference observed in the sounds, the one being compared to a base, and the other to a treble; or as expressed by Worlidge, chap. ix. § 3. “The signs of after-swarms are more certain; when
“the prime swarm is gone, about the eighth or tenth evening after,
“when another brood is ready, and again hath over-filled the hive,
“the next queen beginneth to tune in her treble voice, a mourn-
“ful and begging note; then in a day or two shall you hear the
“old queen in her base note reply, and as it were consent. In the
“morning before they swarm, they come down near the stool, and
“there they call somewhat louder. At the very time of swarming
“they descend to the stool, where answering one another in more
“earnest manner, with thicker and shriller notes, the multitude
“come forth in great haste,” &c. If rainy weather prevents their

swarming a second or third time beyond the fourteenth day, one of the queens, generally the young queen, is slain on the morning of the fifteenth; so impatient are they of the long continuance of divided empire: and so sensible is she of her own danger, that she sometimes tempts a few to accompany her in her flight, be the weather ever so little inviting.

The time of the year in which they most generally swarm, is from the middle of May to the end of June; but sometimes sooner or later, according as the season is more or less favourable. The earliest swarms do not always prove the best, especially if they are so early as the end of April or beginning of May: for the weather often is afterwards so wet and cold, that they are frequently in danger of being destroyed, or greatly reduced, by famine. Though swarms which issue forth so late as July are not in danger of a present famine; yet they scarcely have time and opportunity to lay in a sufficient store for the winter. Towards the season of swarming, the door of the hive should be enlarged, to give the bees the greater freedom to issue out; and it should likewise remain so for young swarms, during the first fortnight or three weeks, to allow the freer entrance to the bees at that time extremely busy in collecting their necessary stores. The entrance should afterwards be gradually lessened, to prevent the otherwise easy access of enemies, of which there is great danger, especially as the autumn advances.

Hives continue sometimes to send forth swarms till the old hive becomes too much weakened, and part of it is empty. It is probable, that the prolific young queens prompt the bees to swarm thus frequently: for it is certain, that if there is not a young mother qualified to bring forth a numerous progeny, though there be ever so great a number of bees, they will all remain, and die rather than quit the hive. This is confirmed by the author of the *Natural History of Bees*. "I have drowned," says he *, "several
" hives, the swarms in which could not be forced out by any means;

* P. 323.

" and

“ and after examining all the bees attentively, I ever found that
“ there was but one single mother, and this the old one; the eggs
“ or maggots of the young queen bees having, I suppose, been de-
“ stroyed by some accident.”

Whenever the bees of a swarm fly too high, they are made to descend lower, and disposed to settle, by throwing among them handfuls of sand or dust; probably the bees mistake this for rain. It is usual at the same time to beat on a kettle or frying-pan; perhaps from its being observed that the noise of thunder prompts such bees as are in the fields to return home. Precautions of this kind are the more necessary, if, as Dr. Warder observes*, “ the bees
“ always provide a place for their habitation before they swarm;
“ either in some hollow tree, or in the hollow part of some old
“ building, or in some deserted hive, which the swarm have already
“ prepared, by cleaning out whatever may be offensive to their
“ cleanly nature.” Of this he gives an instance; and concludes, that “ though they provide themselves of a house before they swarm,
“ and take much pains about it; yet if you are early enough in
“ your taking the swarm, and they find themselves at unawares in
“ a convenient house, they have no mind generally to leave it: but
“ if they rise again the same or next day, be sure hive them not in
“ the same hive again, for it is plain they have some dislike to it.”

When the bees first settle in swarming, indeed when they at any time rest themselves, there is something very particular in their method of taking their repose. It is done, by collecting themselves in a heap, and hanging to each other by their feet. They sometimes extend these heaps to a considerable length. It would seem probable to us, that the bees from which the others hang must have a considerable weight suspended to them. All that can be said is, that the bees must find this to be a situation agreeable to themselves. They may perhaps have a method of distending themselves with air,

* The true Amazons, or the Monarchy of Bees; 8th edit. p. 77.

thereby to lessen their specific gravity ; in the same manner as fishes do, in order to alter their gravity compared with water.

When a swarm divides into two or more bands, which settle separately : this division may proceed from there being two queens, though they sometimes settle separately, when there is but one queen among them. In this case, one of the clusters is larger than the other ; and the bees of the smaller cluster or clusters detach themselves by little and little, till at last the whole unite with the larger cluster, in which the queen is. If there are two queens, and the swarm is early and large, each cluster may be hived separately : or if the clusters unite, one of the queens must be sacrificed to the peace and tranquillity of the hive. If this execution is left to the bees, it generally raises a considerable commotion in the hive, and is done in the evening of the first day ; for if it is delayed till morning, the youngest of the queens will, if possible, take flight, and return to the mother hive. In order to prevent this commotion, it will in this case be adviseable to seize one of the queens alive, and keep her prisoner with about a hundred or more of her subjects, in a box with small holes in it sufficient to admit air, but not so large as to permit the bees to escape. In this box a comb with honey should be given them for sustenance, in case they are kept for some days, that you may have her in reserve, in case a queen may be wanted for another swarm. For this purpose, towards the evening, spread a cloth on a table, and strike the bees down upon it, seize the first queen you spy, as prisoner, while you satisfy yourself that there is another. She will sometimes elude your sight ; but if the bees remain quiet, you may presume there is another, and put the hive over them again, into which they will soon ascend. If you find them quiet, then all is well. But if, instead of working in the morning, the bees fly about irregularly, the queen must be restored to them, for unless a queen is given to them, they will all return to the mother-swarm, which they never do while their queen continues with them, though the young swarm is placed ever so near her. If their queen dies
even

even several weeks after their swarming, they will return to their mother hive, carrying their honey along with them.

When the swarm takes wing, the young queen may fall on the ground, not being able to fly, through some defect in her wings. The poor disabled queen may be picked up on the grass, and put on the edge of a hive, a hat or any other thing on which she may become conspicuous to the swarm; they will immediately collect round her, and may be easily put in a hive. When fallen, she is never found without some attendants, whom nothing but violence can separate from her. In case the queen is not raised from the ground, the bees will return to their first abode; as they are sometimes found to do after they have lighted on a tree, probably owing to the young queen's not coming forth with them, for want of strength, or perhaps courage to trust to her wings for the first time.

As soon as the swarm is settled, the bees which compose it should be got into one of my hives, fitted with a cover, with all convenient speed, to prevent their taking wing again. If they settle on a small branch of a tree, easy to be come at, it may be cut off and laid upon a cloth; the hive being ready to be put immediately over them. If the branch cannot be conveniently cut, the bees may be swept from off it into a hive. Lodge but the queen in the hive, and the rest will soon follow. If the bees must be considerably disturbed in order to get them into a hive; the most adviseable way is to let them remain in the place where they have pitched, till the evening, when there is less danger of their taking wing. If it be observed that they still hover about the place they first alighted upon, the branches there may be rubbed with rue, stinging nettles, or elder leaves, or any other thing distasteful to them, to prevent their returning to it.

The hive should be cleaned with the utmost care, and its inside be rubbed very hard with a coarse cloth, to get off the loose straws, or other impurities, which might cost them a great deal of time and labour to gnaw away.

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The hive should not be immediately set on the stool where it is to remain, but should be kept near the place at which the bees settled, till the evening, lest some stragglers should be lost. It should be shaded, either with boughs, or with a cloth, that the too great heat of the sun may not annoy the bees.

Scarcely has the swarm arrived at its new habitation, when the working bees labour with the utmost diligence, to procure materials for food and building. Their principal aim is not only to have cells in which they may deposit their honey. A stronger motive seems to animate them. They seem to know that their queen is in haste to lay her eggs. Their industry is such, that in twenty-four hours they will have made combs twenty inches long, and wide in proportion. They make more wax during the first fortnight, if the season is favourable, than they do during all the rest of the year. Other bees are at the same time busy in stopping all the holes and crevices they find in their new hive, in order to guard against the entrance of insects which covet their honey, their wax, or themselves; and also to exclude the cold air; for it is indispensably necessary that they be lodged warm.

A second swarm scarcely is, and much less are the subsequent ones, worth keeping single; because, being few in number, they cannot allow so large a proportion of working bees to go abroad in search of store, as more numerous swarms can, after having appointed a proper number for the various works to be done within. For this reason it is adviseable to unite two or more of these last or latter swarms, so as to procure a sufficient number of bees in one hive. Bees sometimes swarm so often, that the mother-hive is too much weakened. In this case the swarms should be restored back; and this should also be done when a swarm produces a swarm the first summer, as it sometimes does. The best way, indeed, is to prevent such swarming, by giving the bees more room: though this, again, will not answer where there is a young pregnant queen;

queen; she well knowing that her life is the forfeit of her remaining at home.

Though all writers acknowledge that one of the queens is constantly slain on these occasions; and generally a considerable number of the working bees; yet none of them, Columella excepted, Lib. 9. C. 9. has proposed the easy remedy of killing the queen of the latter cast or swarm, before the union is made; a means by which the lives of several working bees may be preserved.

If an old hive is so full of bees, that they rest in the night under the board, and yet shew no disposition to swarm, turn the hive bottom up, give it some slight strokes on the sides, so as to alarm the bees. They will immediately run to the extremities of their combs. If you look attentively to the middle of the hive, you will there perceive the queen among the foremost. Seize her between the forefinger and thumb, and confine her in your hand till most part of the bees take wing: let her then go, the bees will soon join her, and settle on some branch of a tree. Put them into an empty hive. Put the old stock in its place, that the bees which have been out in the fields may enter it on their return, and having remained there an hour or so, it is then put on another stand near or next its own. The hive having what may now be called a swarm in it, is then placed on the stand of the old stock: and if the bees in both work regularly, carrying loads, all is well. This backwardness to swarm may be owing to their want of a queen to lead them forth; and the old queen is loath to go, till a young one is bred: yet if a royal cell contains a young queen, the bees in both hives will thrive; as those in the old stock will go on in expectation of the young queen's coming forth.

This separation should not in prudence be attempted, unless you have a queen in reserve: for if the bees in the old stock, when placed on their stand, are in an uproar, there is no queen, nor prospect of a queen among them: and in this case their own queen should be restored to them, and the reserved queen be put to the

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swarm,

swarm, or the bees in the empty hive, which should then be carried to the distance of half a mile, and remain there for a few days, till they have made some works, and may then be brought back to their former station. Care should be taken that the number of bees separated from the old stock be sufficient in number to make a swarm. On this account it is perhaps better to use the following method. A sufficient number of bees should be taken out of the stock, in the manner that shall hereafter be directed, and put in an empty hive. The eye will here judge of the numbers. When one half, or a sufficient number, is got into the empty hive, it should be carried to some distance. The silence in either hive will soon indicate where the queen is. It would be eligible that their own queen remained in the old stock; but if she has not, the reserved queen may be put to them, and they should be immediately restored to their former stand: and the bees or swarm, taken off, be carried to the distance of half a mile as before.

If several days of rainy weather should succeed a swarm's coming off, they may die of famine, if timely relief of honey is not given to them.

Bees are not apt to sting when they swarm; therefore it is not necessary then to take much extraordinary precaution against them. The reverend Mr. Thorley gives a remarkable instance of this; and I mention it the rather, because the steady resolution shewn by the maid on this occasion, is the surest safeguard on any other. He relates it thus*.

“ In the year 1717, one of my swarms settling among the close-
 “ twisted branches of a codling-tree, and not to be got into a hive
 “ without help, my maid-servant being in the garden, offered her
 “ assistance, to hold the hive while I dislodged the bees.

“ Having never been acquainted with bees, she put a linnen cloth
 “ over her head and shoulders, to guard and secure her from their

* Pag. 117.

“ swords.

“ swords. A few of the bees fell into the hive; some upon the
“ ground; but the main body upon the cloth which covered her
“ upper garments.

“ I took the hive out of her hands, when she cried out, the bees
“ were got under the covering, crouding up towards her breast and
“ waist; which put her into a trembling posture. When I per-
“ ceived the veil was of no farther service, she gave me leave to re-
“ move it. This done, a most affecting spectacle presented itself to
“ the view of all the company, filling me with the deepest distress
“ and concern, as I thought myself the unhappy instrument of
“ drawing her into so imminent hazard of her life.

“ Had she enraged them, all resistance had been in vain, and no-
“ thing less than her life would have atoned for the offence.

“ I spared not to urge all the arguments I could think of, and
“ use the most affectionate intreaties, begging her with all earnest-
“ ness in my power, to stand her ground, and keep her present
“ posture; in order to which, I gave her encouragement to hope
“ for a full discharge from her disagreeable companions.

“ I began to search among them for the queen, now got in a
“ great body upon her breast, about her neck, and up to her chin.
“ I immediately seized her, taking her from among the crowd with
“ some of the commons in company with her, and put them toge-
“ ther into the hive. Here I watched her for some time, and as I
“ did not observe that she came out, I conceived an expectation of
“ seeing the whole body quickly abandon their settlement; but in-
“ stead of that I soon observed them gathering closer together, with-
“ out the least signal for departing. Upon this I immediately re-
“ flected, that either there must be another sovereign, or that the
“ same was returned. I directly commenced a second search, and
“ in a short time, with a most agreeable surprize, found a second,
“ or the same: she strove, by entering farther into the croud, to

“ escape me, but I re-conducted her, with a great number of the
 “ populace, into the hive. And now the melancholy scene began
 “ to change, to one infinitely more agreeable and pleasant.

“ The bees presently missing their queen, began to dislodge, and
 “ repair to the hive, crowding into it in multitudes, and in the
 “ greatest hurry imaginable. And in the space of two or three mi-
 “ nutes the maid had not a single bee about her, neither had she so
 “ much as one sting, a small number of which would have
 “ quickly stopped her breath.”

Many people have so strong a dread of bees, that no assurance of safety can prevail upon them to act familiarly with these insects. Indeed there seems to be a hidden quality in some men which renders them disagreeable to bees. In either of these cases, it is advisable to follow the directions given by Mr. Worlidge, *ubi supra*.

“ I have gone among them in their greatest anger and madness,
 “ only with a handful of sweet herbs in my hand, fanning about
 “ my face, as it were, to obscure and defend it. Also, if a bee do
 “ by accident buzz about you, being unprovided, thrust your face
 “ amongst a parcel of boughs or herbs, and he will desert you.
 “ But the most secure way of all, and beyond the completest har-
 “ ness yet published, is to have a net knit with so small meshes, that
 “ a bee cannot pass through, and of fine thread or silk, large enough
 “ to come over your hat, and to lie down to the collar of your
 “ doublet, through which you may perfectly see what you do,
 “ without any danger; having also on a pair of gloves, whereof
 “ woollen are the best.”

Oil of olives, or any mild oil, is thought by many to be a cure for the pain and inflammation arising from the sting of a bee; but repeated experiments have shewn that it fails oftener than it succeeds. It seems probable, that the success sometimes met with was rather an accident than a cure; for there are many people to whom

the sting of a bee does not occasion any pain or inflammation: some men disdain to use the least precaution even when they are sure of many stings. There are, perhaps, many other remedies which owe their reputation to similar causes. Vinegar is equally unsuccessful; bruised parsley is by many thought to give ease; Mr. *Rocque* of *Walham-green* says, that being stung even by a wasp, the leaves of burnet, rubbed pretty hard upon the part so injured, immediately took off the inflammation. Honey, which may be got out of the body of the bee which inflicted the wound, is thought a good cure. Indigo, dissolved in water, has been found effectual; as have the juice of the succulent leaves of vegetables, renewed as often as they grow warm: and some recommend, as the most sure remedy, to heat a piece of iron in the fire, or for want of it to take a live coal, and to hold it as near and as long to the place as you can possibly endure it. One very necessary caution is, to pull out the sting from the wound as soon as possible; for the longer it remains in it, the deeper it pierces, owing to the peculiar make of the sting itself.

A large swarm may weigh seven pounds, and so gradually less, to one pound: consequently a very good one may weigh five or six pounds. All such as weigh less than four pounds should be strengthened by uniting to them a less numerous swarm. The author of the *Natural History of Bees* makes the following calculation.

“ I put,” says he, “ into a scale, a half ounce weight; and, in the
“ other scale, as many bees as made the *equilibrium*. You will suppose that I was obliged to employ dead bees for this purpose. I
“ must observe, by the way, that these were bees which had been
“ killed in a dreadful battle; occasioned by a band of aliens, who
“ endeavoured to seize upon a peopled hive. One hundred and
“ sixty-eight of these dead bees weighed but half an ounce. There
“ consequently are twice an hundred and sixty-eight bees in an
“ ounce, that is, three hundred and thirty-six. Now, if three
“ hundred and thirty-six bees weigh an ounce, there must be five
“ thousand

“ thousand three hundred and sixty-six in sixteen ounces or a pound;
“ and consequently thirty-seven thousand five hundred and sixty-
“ two bees to weigh seven pounds.”

In order to be satisfied on this point, I took some bees out of a hive on the 9th of March 1768, being a very cold day, and suffered them to fly to a window, which soon chilled them so, that they fell as dead. Of these I collected as many as weighed half an ounce, and found the number to be one hundred and fifty-four, which gives to the pound four thousand nine hundred and twenty-eight. I weighed another half ounce of other bees and found the numbers to be the same.

The different circumstances of the bees may occasion a considerable difference in their weight. When the bees swarm they come out loaded with wax and honey; and therefore weigh much heavier than bees taken thus by chance, as was the case in both the above experiments: and therefore the number of the bees is not to be thus computed, from the weight of the swarm: for one fourth of the number, at least, should be deducted, in lieu of the wax and honey they have brought off with them. There is also another allowance to be made, namely, that when alive they do not probably weigh so heavy as when dead. About twenty thousand bees compose a very large swarm.

CHAP. III.

Of the Management of Bees in Hives and Boxes.

I HAVE already mentioned that the swarms are put into one of my hives, which has a cover fitted to it. A good swarm will soon fill one of these hives, and therefore another hive may be put under it the next morning. The larger space allowed the bees, will excite their industry in filling them with combs. The queen will lay some eggs in the upper hive; but so soon as the lower hive is filled with combs, she will lay most of them in it. In little more than three weeks, all the eggs laid in the upper hive will be turned to bees, and if the season is favourable, their cells will be soon filled with honey.

So soon as they want room, a third hive should be placed under the two former, and in a few days after the end of three weeks from the time the swarm was put into the hive, the top hive may be taken away at noon of a fair day; and if any bees remain in it, carry it to a little distance from the stand, and turning its bottom up, striking it on the sides, the bees will be alarmed, take wing, and join their companions in the second and third hives. If it is found that they are very unwilling to quit it, it is probable that the queen remains among them. In this case the bees must be treated in the manner that shall be directed, when I give directions for taking the honey and wax without killing them. The upper hive now taken away, should be put in a cool place, in which no vermin, mice, &c. can come at the combs, or other damage can happen to them, and be thus preserved in reserve.

So soon as the hives seem to be again crowded, and the upper hive is well stored, or filled with honey, a fourth hive should be placed under the third, and the upper hive be taken off the next fair day at noon, and treated as already directed. As the honey
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made during the summer is the best, and as it is needless to keep many full hives in store, the honey may be taken out of the combs of this second hive for use.

If the season is very favourable, the bees may still fill a third hive. In this case a fifth hive must be put under the fourth, and the third taken away as before. The bees will then fill the fourth for their winter store. As the honey of the first hive is better than the honey collected so late as that in the third, the honey may be taken out of the combs of the first, and the third may be preserved with the same care as directed for that.

In the month of September the top hive should be examined and if full, it will be a sufficient provision for the winter: but if light, that is, not containing twenty pounds of honey, the more the better, then in the month of October, the fifth hive should be taken away, and the hive kept in reserve should be put upon the remaining one, to supply the bees with abundant provisions for the winter. Nor need the owner grudge them this ample store, for they are faithful stewards, and will be proportionally richer, and more forward in the spring and summer, when he will reap an abundant profit. The fifth hive which was taken away should be carefully preserved during the winter, that it may be restored to the same stock of bees, when an additional hive is wanted next summer: or the first swarm that comes off may be put into it. The combs in it, if kept free from filth and vermin, will save them much labour, and they will at once go to the collecting of honey.

It is almost needless to observe, that when the hives are changed, a cover, as already directed for the first, should be put upon every upper hive: and that when a lower hive becomes an upper hive, the door of it should be shut up, that so their only passage out shall be by the lower hive; for otherwise the queen would be apt to lay eggs in both indiscriminately. The whole of the above detail of the
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management of one hive, may be extended to any number: it may be proper to keep a register of each set, because, in restoring hives to the bees, they may be better pleased at receiving their own labours, than that of other stocks.

If in the autumn the owner has some weak hives, which have neither provision nor numbers sufficient for the winter, it is advisable to join the bees to richer hives: for the greater number of bees will be a mutual advantage to one another during the winter, and accelerate their labours much in the spring. For this purpose, carry a poor and a richer hive into a room, a little before night: then force the bees out of both hives into two separate empty hives, in a manner that shall be hereafter directed; shake upon a cloth the bees out of the hive which contains the fewest, search for the queen, and as soon as you have secured her with a sufficient retinue, bring the other hive, which contains the greater number, and place it on the cloth on which the other bees are, with a support under one side, and with a spoon, shovel the bees under it. They will soon ascend; and while under this impression of fear, will unite peaceably with the other bees: whereas had they been added to the bees of the richer hive, while in possession of their castle, many of the new-comers must have paid with their lives for their intrusion.

I at first supposed that the bees were purchased in common hives: it is now therefore proper to return to the old original hives, which generally contain from two pecks to a bushel.

So soon as the swarm is come out, one of my hives should be put under it; and if the bees soon want room, a second should be added; for as in these large hives, the number of young bees may be great, room should be given to them proportioned to their numbers. The two additional hives may become here more necessary, because as the old hive is very large, the queen may be tempted to continue

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laying

laying eggs longer in it, and longer time will be necessary to fill it with honey. When well stored with honey it is taken away, and the honey and wax is turned to the proprietor's profit. The bees being now left entirely to my hives, are to be afterwards managed as already directed; observing only, that no second or subsequent swarm be permitted to quit the hives; but if such come forth, they be again restored to it, the young queen being secured.

It will now be proper to compare the old and my hives together, that we may state an account of the advantages and disadvantages of each.

The object of keeping bees is undoubtedly the procuring honey and wax in the greatest plenty, and coming at them with the greatest ease. In both these respects, I think the advantages will be found on the side of my hives.

A hive made as large as usual, requires a good season to fill it with honey; and when robbed of part of its riches, the bees may not have an opportunity of filling it with combs and honey. Aye! but when robbed, it contains a great deal of honey; it does, but if a considerable portion of it is taken away, the bees may be starved in the winter.

The succession of my hives keeps the bees constantly employed; perhaps excites their industry on the frequent returns of new habitations: and therefore the quantity of honey and wax obtained will not, I think, be less; and the method of coming at it is both simpler and easier, and there is little danger of the bees being starved, because I have advised that store hives with honey be reserved, for a certain supply of food.

The use of a hive is to afford a safe lodging to the bees, and a conveniency for stowing their provisions. Two of my hives abundantly answer these purposes, and the bees are able to fill two of
mine

mine as soon as they can one of the old construction; which is attended with this considerable advantage, that the honey thus procured is more fragrant than honey which remains longer exposed to the perspiratory matter of the bees, and to the heat of the hive; for these rob it not only of its fragrance, but also of its colour, which becomes darker the longer the honey remains in the hive, as may be evidently concluded from the different colours of new and of old combs.

It is well known to those who are conversant in the care of bees, that their numbers decrease greatly in the autumn, not only by the murder of the drones, but also by the unavoidable deaths of many of the working bees; owing to the thousand accidents they meet with in the fields, and to age. A much less space is therefore wanted for them in the winter, than was necessary in the summer; and the closer they are collected together in the winter the warmer they will be. Surely this end is more effectually obtained in my hives, one of which is fully sufficient to contain the number of bees that remain at that season, I think I may say better, than a large mansion, of which they fill but a corner. If the upper hive is so full of honey, that it cannot contain them at the beginning of the winter, the lower hive yields abundant room till they have consumed so much honey as to make room in the upper, and by raising them higher from the stool, it adds to their warmth.

Let me in farther vindication of my plan, add what the Count de la Bourdonnaye says of the use of his hives, in which the reader will observe a similarity of opinion, which I have vanity enough to think does me honour. "When the bees, says he, have filled
" the upper half, the combs are necessarily interrupted by the intermediate bottom; and this perhaps, induces them to fill that
" half more completely than they would do if they met not with
" such a stop. When both parts are full, which may be known
" by the bees wanting room, the upper half is taken away, and as
M 2 " soon

“ soon as it has been emptied, it is put under the remaining full
“ half.

“ Whilst the bees are filling the lower half of the hive, the eggs
“ laid in the upper half become bees: and as the queen deposits
“ her eggs as near the entrance as can be done with safety to the
“ young, she never lays any in the upper half, after it is become
“ the upper half; but as fast as the bees are perfected there, the
“ cells are filled with honey. By this means none of the young
“ brood are lost, and almost the whole of what is taken consists of
“ honey and wax.

“ The hives stand separate, and at a distance from walls. No
“ plants are suffered to rise high near them; and the stool is raised so
“ high from the ground, that mice, their very dangerous enemies,
“ cannot jump up to it.”

When a swarm is to be put into one of the boxes, the slider at bottom, or one of the panes of glass in the lower part is taken out, and the bees will readily enter, especially if the queen has been put into the box before them: the slider or pane of glass is then returned to its place, and the bees will go to work by the mouth of the box.

The bees will naturally fill the upper part of the boxes first, and so work downward. When the owner sees that the boxes are crowded, and that the combs in the upper part are well stored with honey, (which he can easily be assured of by looking in at one or two of the doors) the slider at top is taken off, and one of the frames with the combs in it is taken out, the slider being immediately returned. If on first looking into it, many bees appear in and about the combs in the frame, repeated taps may be given the glass next to the frame, and the bees will probably quit it, retiring to other parts of the box; or if but a few are seen on it, the frame may be taken out, and the bees being swept off with a feather, will

return

return to their companions. The combs are then taken out of the frame, by slipping out the moving sliders, and when cleaned, the frame is again returned to its place. The other frame may be taken out at the same time, or it may be delayed for a few days, thereby to have a more frequent seizure of combs.

When the combs are taken out of the lower part of the boxes, it should be done immediately after the combs are taken out of the upper frames; then giving some gentle taps on the glasses below, the bees will ascend, and the slider which enters between the boxes being put in, a pane of glass is taken out, the combs are cut from the bars at top, and as soon as cleared of every remains of combs, the pane is again put in. If some bees remain on the combs, they may be brushed off, and the slider being again drawn out, the bees will soon return to their labours.

As the boxes are only secured together by clasps, the upper part may be taken intirely away when full of honey, returning the bees to their fellows, and an empty fresh box may be put in its place.

The reader will perceive that this method of robbing the bees occasionally and so easily, of part of their combs, is preferable to the former practice of necessarily taking the whole box at once. If the owner's curiosity prompts him to examine frequently how the bees proceed in their labours, the boxes, Fig. 3. Plate II. afford an easy opportunity; for as there are but three combs in each separate frame, he can at any time discover where the queen is, and how she is employed, as well as see the labours of the working bees: and this with a distinctness and ease, incomparably superior to what can be done in glass-hives.

If the weather is very warm, the bees in these boxes may be subject to considerable inconveniencies, especially if, as Dr. Warder *

* Monarchy of Bees, p. 128.

observes

observes, that when the appearance of a shower drives the bees home in such crouds, that pressing to get in, they stop the passage so close, that those within are almost suffocated for want of air; which makes these last so uneasy, that they are like mad things. In this extremity, he has lifted the whole colony up a little on one side, and by thus giving them air, has soon quieted them. He has known them, he says, come pouring out, on such an occasion, in number sufficient to have filled at once two or three quarts; as if they had been going to swarm.

The Memoirs of the truly laudable Berne Society, for the year 1764, give us a particular instance of this, when they say †, that in 1761, many in Swisserland were obliged to smother their bees, when they saw the honey and wax trickling down; not knowing any other remedy for the losses they daily sustained. Some shaded their hives from the sun, or covered them with cloths wet several times a-day, and watered the ground all around. In this case the slider at top of my boxes may be drawn back, or a similar slider may be prepared, perforated with small holes, which will cause a current of air through the box.

† P. 116.

CHAP. IV.

Of shifting the abodes of bees.

GREAT improvements may certainly be made in the essential article of providing plenty of pasture for bees, whenever this subject shall be more carefully attended to than it, unfortunately, has hitherto been. A rich corn country is well known to be a barren desert to them during the most considerable part of the year; and therefore the practice of other nations, in shifting the places of abode of their bees, well deserves our imitation.

Columella * informs us, that, as few places are so happily situated as to afford the bees proper pasture both in the beginning of the season and also in the autumn, it was the advice of Celsus, that after the vernal pastures are consumed, the bees should be transported to places abounding with autumnal flowers; as was practised by conveying the bees from Achaia to Attica, from Eubœa and the Cyclad islands to Scyrus, and also in Sicily, where they were brought to Hybla from other parts of the island. He likewise directs, that the hives be carefully examined before they are removed from one place to another, and to take out such combs as appear old, loose, or have moths in them, reserving only those that are sound, in order that the hive may be stored with combs collected from the best flowers.

We find by Pliny, that this was likewise the practice of Italy in his time. “As soon, says he †, as the spring food for bees has failed
“in the vallies near our towns, the hives of bees are put into boats,
“and carried up against the stream of the river, in the night, in
“search of better pasture. The bees go out in the morning, in

* Lib. ix. c. 14.

† Lib. xxi. c. 12.

“ quest of provisions, and return regularly to their hives in the boats,
 “ with the stores they have collected. This method is continued,
 “ till the sinking of the boats to a certain depth in the water shews
 “ that the hives are sufficiently full; and they are then carried back
 “ to their former homes, where their honey is taken out of
 “ them.”

A much later writer, Alexander de Montfort, shews this to be still the practice of the Italians who live near the banks of the Po, (the river which Pliny instanced particularly in the above quoted passage) when he says * that, treating their bees in nearly the same manner as the Egyptians did and do theirs, they load boats with hives, and convey them to the neighbourhood of the mountains of Piedmont; that, in proportion as the bees gather in their harvest, the boats, by growing heavier, sink deeper into the water; and that the watermen determine from thence, when their hives are loaded sufficiently; and that it is time to carry them back to the places from whence they came. The same author relates †, that the people of the country of Juliers used the same practice; for that, at a certain season of the year, they carried their bees to the foot of mountains covered with wild thyme.

M. Maillet relates, in his curious description of Egypt ‡, “ that spite
 “ of the ignorance and rusticity which have got possession of that
 “ country, there yet remain in it several footsteps of the industry and
 “ skill of the antient Egyptians. One of their most admirable con-
 “ trivances is, their sending their bees annually into distant countries,
 “ in order to procure them sustenance there, at a time when they
 “ could not find any at home; and their afterwards bringing them
 “ back; like shepherds who should travel with their flocks, and
 “ make them feed as they go. It was observed by the antient in-

* Natural Hist. of Bees, p. 427.

† Natural Hist. of Bees, p. 428.

‡ Tom. ii, p. 24.

“ habitants of lower Egypt, that all plants blossomed, and the
“ fruits of the earth ripened, above six weeks earlier in upper
“ Egypt, than with them. They applied this remark to their
“ bees; and the means then made use of by them, to enable these
“ usefully industrious insects to reap advantage from the more for-
“ ward state of nature there, were exactly the same as are now
“ practised, for the like purpose, in that country. About the end
“ of October, all such inhabitants of the lower Egypt as have hives
“ of bees, embark them on the Nile, and convey them upon that
“ river quite into upper Egypt; observing to time it so that they
“ arrive there just when the inundation is withdrawn, the lands
“ have been sown, and the flowers begin to bud. The hives thus
“ sent are marked and numbered with their respective owners, and
“ placed pyramidically in boats prepared for the purpose. After
“ they have remained some days at their farthest station, and are
“ supposed to have gathered all the wax and honey they could find
“ in the fields within two or three leagues around; their conduc-
“ tors convey them, in the same boats, two or three leagues lower
“ down, and there leave the laborious insects so long time as is
“ necessary for them to collect all the riches of this spot. Thus,
“ the nearer they come to the place of their more permanent abode,
“ they find the productions of the earth, and the plants which
“ afford them food, forward in proportion. In fine, about the
“ beginning of February, after having travelled through the whole
“ length of Egypt, gathering all the rich produce of the delightful
“ banks of the Nile, they arrive at the mouth of that river, to-
“ wards the ocean; from whence they set out, and from whence
“ they are now returned to their several homes: for care is taken
“ to keep an exact register of every district from whence the
“ hives were sent in the beginning of the season, of their num-
“ bers, of the names of the persons who sent them, and like-
“ wise of the mark or number of the boat in which they were
“ placed.”

The author of the Natural History of Bees gives the following account of what is practised in this way in France; an example well worth our imitation in many parts of this kingdom. “ M. Proutaut, “ says he*, keeps a great number of hives. His situation is one of “ those in which flowers become rare or scarce very soon, and “ where few or none are seen after the corn is ripened. He then “ sends his bees into Beauce, or the Gatinois, in case it has rained in “ those parts. This is a journey of about twenty miles, which he “ makes them take. But if he concludes that the bees could not “ meet, in either of those countries, wherewith to employ them- “ selves advantageously, he then has them carried into Sologne, “ about the beginning of August; as knowing that they will there “ meet with a great many fields of buck-wheat in flower, which “ will continue so till about the end of September. His method “ of transporting them is thus. His first care is, to examine those “ hives, some of whose honey-combs might be broken or separated “ by the jolting of the vehicle; they are made fast one to the “ other, and against the sides of the hive, by means of small sticks, “ which may be disposed differently as occasion will point out. “ This being done, every hive is set upon a packing-cloth, or “ something like it, the threads of which are very wide: the sides “ of this cloth are then turned up, and laid on the outside of each “ hive, in which state they are tied together with a piece of small “ pack-thread wound several times round the hive. As many hives “ as a cart built for that purpose will hold, are afterwards placed in “ this vehicle. The hives are set two and two, the whole length of “ the cart. Over these are placed others; which make, as it were, “ a second story or bed of hives. Those which are stored with “ combs should always be turned topsy-turvy. ’Tis for the sake “ of their combs, and to fix them the better, that they are disposed “ in this manner; for such as have but a small quantity of combs “ in them, are placed in their natural situation. Care is taken in this “ stowage, not to let one hive stop up another; it being essentially

* P. 428.

“ necessary

“ necessary for the bees to have air ; and it is for this reason they are
“ wrapped up in a coarse cloth, the threads of which were wove
“ very wide, in order that the air may have a free passage, and less
“ sen the heat which these insects raise in their hives ; especially
“ when they move about very tumultuously, as often happens in
“ these carts. Those used for this purpose in Yèvre, hold from
“ thirty to forty-eight hives. As soon as all are thus stowed, the
“ caravans set out. If the season is sultry, they travel only in the
“ night ; but a proper advantage is made of cool days. You’ll ima-
“ gine they don’t ride post. The horses must not be permitted even
“ to trot ; they are led slowly, and through the smoothest roads.
“ When there are not combs in the hives sufficient to support the
“ bees during their journey, the owner takes the earliest opportu-
“ nity of resting them wherever they can collect wax. The hives
“ are taken out of the cart, and then set upon the ground, and af-
“ ter removing the cloth from over them, the bees go forth in search
“ of food. The first field they come to serves them as an inn.
“ In the evening, as soon as they are all returned, the hives are shut
“ up ; and being placed again in the cart, they proceed in their
“ journey. When the caravan is arrived at the journey’s end, the
“ hives are distributed in the gardens ; or in fields adjacent to the
“ houses of different peasants, who, for a very small reward, under-
“ take to look after them. Thus it is that, in such spots as do not
“ abound in flowers at all seasons, means are found to supply the
“ bees with food during the whole year.”

Before the hives are removed with a view of sending them to better pasture, those that are well stored with honey, if of my construction, should be laid by, lest the weight of the honey should break the combs. If the bees are in a hive of the old make, it should be robbed of its heaviest combs for the same reason. It should be robbed some days before the removal, because the bees will not have time to secure sufficiently the combs with young in them, which might have been loosened.

Water carriage is certainly the best where it can be had. When necessarily transported by land, the hives should be carried either by hand, or suspended on a pole on mens shoulders. Carriages hung on springs, such as post-chaifes, drove with care, might answer this purpose. If the hives are laid on a board, one side should be raised to give them air: and if by their noise they express any uneasiness from heat, the hives must be turned bottom up, in order to cool them; and if the weather is very hot, the bees may be taken out of the hives every evening, and returned again in the morning before they are put on their stands. The hive should be transported in the night, and rested during the day, each hive being rested on a temporary stand during the day, that the bees may go forth in search of food, or that they may at least have it in their power to go out; for a long restraint would be extremely irksome to them. I cannot approve of the practice of letting the hives remain in the boats, because many must lose their lives by being blown into the water with sudden gusts of wind, or other accidents.

This practice would certainly make an ample return for the trouble, if brought into general use, in several parts of this kingdom. In vallies the plants bloom early, and are cut down more early in the season. Rising grounds would in this case afford a better pasture; and if there is heath at a convenient distance, the hives being carried thither, would considerably lengthen out the season of collecting honey; for it continues in bloom till late in August. The bees will themselves go far in search of food; but surely carrying them to the spot whence they obtain their food, saves much of their time and labour, and becomes a proportionable gain to the owner; for by this means they collect the more honey in the same time.

C H A P. V.

Of the Methods practised for taking the Wax and Honey, without destroying the Bees.

WERE we to kill the hen for her egg, the cow for her milk, or the sheep for the fleece it bears, every one would instantly see how much we should act contrary to our own interest: and yet this is practised every year, in our inhuman and impolitic slaughter of the bees. Would it not argue more wisdom in us, to be contented with taking away only a portion of their wax and honey, as is the practice of many countries. I shall trace this practise from the earliest accounts we have of it, to the present, and conclude with the method I practise myself, when I take only a part of their wealth.

The following are the directions given by Columella * for taking the wax and honey, in the more humane and judicious manner of saving the lives of the bees.

“ Choose the early morning, before the bees are stirring; for it
 “ is not proper to exasperate them in the middle of the day: have
 “ ready two knives, about a foot and an half long; one with a cut-
 “ ting edge on each side; the other of a curved form, with a very
 “ sharp edge on one side only, and a back fashioned for scraping.
 “ With the former of these, cut down the combs; and with the
 “ latter scrape off whatever fragments may have been left. Have
 “ also ready an earthen pot, with live coals in it, and with a funnel-
 “ shaped cover, through which the smell of galbanum, or of dried
 “ dung, may be conveyed to any part of the hive, in order to drive
 “ the bees from the combs intended to be taken away.

“ The first season for taking the combs is when the bees are ob-
 “ served to expel the drones. The combs always hang from the

* Lib. ix. c. 15. See also Varro de Re rustica, lib. iii. c. 16.

“ roof of the hive, adhering but little to the sides. In other res-
“ pects, they are of a shape fitted to the figure of the hive. At the
“ first time of taking the combs, only one fifth part of them need
“ be left; because the fields still continue to abound in food for the
“ bees: but at the second taking, about the autumnal equinox, a
“ third part should be left, on account of the then approaching
“ winter. This, however, is not an invariable rule; for it should
“ be altered according to the nature of the seasons, and the greater
“ or less plenty of food in different situations. The combs are cut
“ out with the cutting knife, and whatever fragments of them are
“ left, may be pared off with the crooked knife. All the old
“ combs, and such as are any way impaired by vermin or otherwise,
“ should be taken away, as well as those that are full of honey.
“ The combs which contain bee-bread, or young bees, should be
“ left; the former for a supply of food, and the others for a recruit
“ of young bees. The hive should be so placed when the combs
“ are first cut, that the remaining combs may be easily come at
“ when these last are also to be taken; for the older the combs are,
“ the worse is the honey.

“ All the combs should then be carried into the place where the
“ honey is to be separated from the wax; and particular care should
“ be taken to stop every hole through which the bees might find
“ admittance into this place, because they would otherwise be very
“ troublesome during that operation. Dry dung may be kept burn-
“ ing at the door, to prevent their entrance there.

“ The honey should be drained from the combs as soon as pos-
“ sible; and those combs which have young bees in them, or are
“ any ways damaged, should be carefully parted from the rest, lest a
“ bad flavour be communicated to the honey. The honey which
“ flows freely should be kept by itself, as being the purest and
“ best.”

Somewhat similar to this, but simpler, and so far better, is the method now practised in Greece, as related by Mr. Wheeler*.

“ Mount Hymethus is celebrated for the best honey in all Greece.
“ We eat of it very freely, finding it to be very good, and were not
“ at all incommoded with any gripings after it. This mountain was
“ not less famous in times past for bees and admirable honey; the
“ ancients believing that bees were first bred here, and that all other
“ bees were but colonies from this mountain; which if so, we as-
“ sured ourselves that it must be from this part of the mountain
“ that the colonies were sent; both because the honey here made is
“ the best, and that here they never destroy the bees. It is of a
“ good consistence, of a fair gold-colour, and the same quantity
“ will sweeten more water than the like quantity of any other doth.
“ The natives wondered at my comrade, in that he preferred the
“ white honey of France; telling him, that white honey is raw,
“ and not rightly concocted either by nature or the bees. I no
“ sooner knew that they never destroy or impair the stock of bees
“ in taking away their honey, but I was inquisitive to understand
“ their method of ordering the bees; which being an art so worthy
“ the knowledge of the curious, I shall not think it beside the pur-
“ pose, to relate what I saw, and was informed to that effect, by such
“ as had skill in that place.

“ The hives they keep their bees in are made of willows or
“ osiers, fashioned like our common dust-baskets, wide at top
“ and narrow at the bottom, and plaistered with clay or loam
“ within and without. They are set with the wide end up-
“ most. The tops are covered with broad flat sticks, which are
“ also plaistered over with clay; and to secure them from the
“ weather, they cover them with a tuft of straw, as we do. Along
“ each of these sticks, the bees fasten their combs; so that a comb

* A Journey into Greece, by George Wheeler, Esq; in Company with Dr. Spon of Lyons, p. 411.

“ may

“ may be taken out whole, without the least bruising, and with the
“ greatest ease imaginable. To increase them in spring-time, that
“ is in March or April, until the beginning of May, they divide
“ them; first separating the sticks on which the combs and bees
“ are fastened, from one another, with a knife: so taking out the
“ first comb and bees together on each side, they put them
“ into another basket, in the same order as they were taken
“ out, until they have equally divided them. After this, when they
“ are both again accommodated with sticks and plaister, they set
“ the new basket in the place of the old one, and the old one in
“ some new place. And all this they do in the middle of the day,
“ at such time as the greatest part of the bees are abroad; who at
“ their coming home, without much difficulty, by this means di-
“ vide themselves equally. This device hinders them from swarm-
“ ing and flying away. In August they take out their honey,
“ which they do in the day-time also, while they are abroad; the
“ bees being thereby, say they, disturbed least: at which time they
“ take out the combs laden with honey, as before; that is, begin-
“ ning at each outside, and so taking away, until they have left
“ only such a quantity of combs, in the middle, as they judge will
“ be sufficient to maintain the bees in winter; sweeping those bees
“ that are on the combs into the basket again, and again covering it
“ with new sticks and plaister.

“ All that I doubt concerning the practice of this here in Eng-
“ land, is, that perhaps the bees gather a less quantity of honey in
“ this country; and that, should we take from them a like propor-
“ tion of it, they would not have enough left to preserve them in
“ winter. But this hinders not much: for by being less cove-
“ tous, and not taking so much honey from the poor bees, the great
“ increase and multiplying of them would soon equalize, and far
“ exceed the little profit we have by destroying them. This is
“ done without the smoke of sulphur, which takes away very much
“ of

“ of the fragrance of the wax: and sure I am, that the honey can
 “ receive neither good taste, nor good smell, from it.”

Mr. Wheeler likewise informs us, that whilst he was viewing the beauties of Parnassus, he enjoyed the sweets of a repast of honey thus easily come at. “ After I had discoursed some time,” says he*,
 “ with the good old Caloyer (Priest), whom they esteemed a saint,
 “ I was conducted into a garden well planted with beans and peas
 “ (this was at the end of January), and another by it furnished with
 “ four or five hundred stocks of bees. The good old Caloyer presently went, took a stock of bees, and brought me of delicate
 “ white honey-combs, with bread and olives, and very good wine;
 “ to which he sat us down in his hut, and made us a dinner, with
 “ far greater satisfaction than the most princely banquet in Europe
 “ could have afforded us.”

That the number of our hives might be greatly increased wherever there is proper pasture for bees, appears evidently from Mr. Wheeler's narrative, and is confirmed by the following passage in the account lately published of the sheep in Spain.

“ If sheep loved aromatic plants, it would be one of the greatest
 “ misfortunes that could befall the farmers in Spain. The number
 “ of bee-hives there is incredible. I am almost ashamed to give
 “ under my hand, that I knew a parish-priest who had five thousand hives. The bees suck all their honey, and gather all their
 “ wax, from the aromatick flowers, which enamel and perfume
 “ two-thirds of the shew-walks. This priest cautiously seizes the
 “ queens in a small crape fly-catch, and then clips off their wings,
 “ after which their majesties stay at home: he assured me, that he
 “ never lost a swarm from the day of this discovery, to the day he
 “ saw me, which was, I think, five years after.”

* P. 326.

The Greek method, which Mr. Wheeler relates, of sharing the honey with the bees, has been lately introduced into France, as we are informed by Mess. de Réaumur and Du Hamel. The latter gives the following account of it, in the Memoirs of the Royal Academy of Sciences, for the year 1754*.

“ M. Prouteau made great improvements in the management of
 “ bees. I took a singular pleasure in being, from time to time, an
 “ eye-witness of the progress of his researches, and in admiring the
 “ success of his industry. I took notes of what I saw, and com-
 “ municated them to M. de Réaumur, who has added them to his
 “ own very interesting observations on bees. The methods prac-
 “ tised by M. Prouteau have rendered our province of Gatinois
 “ somewhat famous.

“ M. Prouteau is dead; but the taste for rearing bees has
 “ increased. This spirit of inquiry being continued, several suc-
 “ cessful trials have been made, and particularly by the Sieur
 “ Desbois at Pethiviers, who excels in the management of these
 “ little animals. He has devised new methods of practice, which
 “ are adopted by all who rear bees.

“ It is true, that the first hints of these practices may be found in
 “ M. de Réaumur's works: but it is right to inform the public,
 “ that they are executed in an extensive manner, and with success;
 “ were it only to refute the prejudice of those who lay to the charge
 “ of inquirers into nature, that their pursuits are only matters of
 “ mere curiosity and amusement.

“ To shew in their order the discoveries that have been made in
 “ this province, I shall here run over the different operations which
 “ succeed one another during the course of a year.

“ As soon as the severity of the winter is over, the bees go forth
 “ from their hives, to gather in their harvest from the trees which

* P. 331.

“ are first in bloom. They are seen at this season to alight on the
“ bark of resinous trees, from whence they are thought to gather
“ the propolis. They are permitted to indulge themselves peace-
“ ably in these occupations, till the coming out of the first swarms,
“ which generally lasts from the 20th of May to the 20th of June.

“ Their swarming is watched with great vigilance, and all pos-
“ sible care is taken to put both the strong and weak swarms into
“ hives. The strong ones form good hives ; and the weak ones
“ serve to strengthen those which stand in need of their assistance,
“ as I shall hereafter explain : for the greatest part of the art of
“ managing these insects consists in keeping the hives always well
“ stocked with bees ; these being so many labourers which work
“ with surprising activity to enrich their master.

“ As the swarms or casts which come in July are small, they
“ should always be made use of to strengthen weak hives ; though
“ many without troubling themselves about these little swarms, shift
“ their bees from one hive into another, from the very beginning
“ of July, in order to possess themselves of all the wax, and all the
“ honey, which they have amassed in great quantity from off the
“ spring flowers. The manner of performing this operation is
“ thus :

“ One or two openings are made at the top of the hive intended
“ to be emptied ; by cutting down the osiers which run cross-wise,
“ and sparing as much as possible those which run length-wise, in
“ order that it may be repaired after it has been emptied, by weaving
“ in new osiers. This hive is then placed on the back of a chair,
“ the end of which is rested on a bench, and the hive-into which
“ the bees are to be driven is set over that other hive.

“ To prevent the bees from escaping between the hives, these are
“ wrapped up in a large cloth tied round with a cord. An earthen
“ pot with live coals in it, covered with a few linen-rags, to make a

“ great deal of smoke, is put under the chair, that the smoke may
 “ get into the full hive. The bees, incommoded by the smoke,
 “ ascend to the top, and finding there an opening, go into the
 “ empty hive, to avoid that nuisance. When it is supposed that
 “ they are all got into the upper hive, this is gently lifted off, and
 “ set upon the ground, and the full hive is carried away quickly.

“ It is well known, that the propagation of their species is what
 “ the bees have most of all at heart. Take away their provisions,
 “ which they have been at infinite pains to amass, and they will pro-
 “ cure themselves a new store: but if their brood is taken from
 “ them, the discouragement is sensible, and nothing but the hope of
 “ seeing their queen lay eggs anew can determine them to return
 “ to their labours. Accordingly, it is observed, that when the brood
 “ is preserved in changing the hives, the activity is much greater
 “ than when the bees are deprived of them.

“ To explain the manner in which the young are preserved, it is
 “ necessary to premise, that the smoke of rags intoxicates the bees
 “ in some degree, from which they gradually recover. While they
 “ are in that state, the combs are taken out of the hive from which
 “ the bees have been driven, and such of them as are full of honey
 “ are set apart for the profit of the owner, who takes great care not
 “ to damage those which contain the young, and replace them quite
 “ at the top of a new hive, where they are supported by sticks run
 “ across. This hive is placed near to that in which the bees were
 “ left; and upon giving this last a smart stroke with the hand, the
 “ bees in it fall to the ground, where they are instantly covered with
 “ that in which the combs with the young brood were fixed. The
 “ bees soon recovering, ascend into this hive, where, finding their
 “ young, they set to work with incredible alacrity to repair their
 “ losses: they soon fasten the combs with their young offspring
 “ either to the hives, or to the sticks: the nymphs which have
 “ been killed in the course of this operation are taken out of the
 “ cells,

“ cells, which are then filled with honey ; new combs are imme-
“ diately set about ; the remaining nymphs soon become bees ; and
“ by this increase of the number of labourers, the cells are quickly
“ filled with honey. That this may be more speedily accomplished,
“ the bees are removed to places where they find plants still in
“ bloom. Of this kind are heath, melilot, broom, vetches, buck-
“ wheat, wild mustard, or charlock growing in too great plenty in
“ corn-fields, and especially the *virga aurea Virginiana Zanoni*,
“ which our peasants call bastard-hemp.

“ If the weather is favourable, and there is plenty of flowers, the
“ hives that were first changed are well filled towards the end of
“ August. When that is the case, they are emptied a second time ;
“ still with the same care of their young : and as it is of the highest
“ importance that the hives be always well stocked with bees, it is
“ at this time found necessary to strengthen some hives, by uniting
“ the bees of two hives into one.

“ When it is intended to unite the bees of two hives, one of them
“ is fumigated as before, so as to force the bees into an empty hive.
“ Being then struck to the ground, they are covered with the hive
“ which is to receive this reinforcement. The strange bees mingle
“ with the others, and form one family, generally without much
“ contention ; though sometimes there arises a quarrel which costs
“ the lives of many bees ; and it is thought that these hostilities do
“ not cease till one of the mothers has been killed. If there be
“ several weak hives, and none of the others stand in need of being
“ re-inforced, two or three of the weak ones may be united toge-
“ ther ; for in this state they often turn out very profitable.

“ As soon as the hives have been changed a second time, they
“ are carried into the neighbourhood of a field of buck-wheat,
“ to enable the bees to collect a third store ; and in a favourable
“ season for working, when there is not either much rain or stormy
“ wind,

“ wind, and the flowers blow well, the hives are so well filled by
 “ the end of September, that near half a foot of the combs may be
 “ pared off. This operation requires few precautions: the hive is
 “ laid on a chair a little inclined, and the bees are forced to retire to
 “ the top of the hive, by blowing in smoke between the combs,
 “ which are then cut without the least disturbance from the
 “ bees.

“ It is almost needless to say that the hives should not be changed
 “ again, unless they are very heavy, and well stocked with bees.
 “ And even if they are, the hazard of their not recruiting their loss,
 “ in this late season of the year, should not be ventured for the in-
 “ considerable profit they would yield: for the honey which is
 “ collected from buck-wheat is always yellow, and of little value.

“ In the beginning of October, the hives should be visited, or ra-
 “ ther weighed by hand, in order to give honey to the bees of such
 “ as are light, and therefore judged not to have a sufficiency of pro-
 “ vision for the winter; a subject which will be spoken of hereafter.
 “ But in the mean time I ought not here to pass over in silence a fact
 “ which none of us could account for.

“ Having visited our hives this autumn, to see which of them
 “ would want help, we found one very light, and judged that
 “ six pounds of honey should be given to this hive. Four or five
 “ days after, when this hive was lifted up, in order to put the plate
 “ of honey under it, it was found to be very heavy, without
 “ its being possible to conceive how, in so advanced a season, the bees
 “ could have collected so much. We suspected that they had plun-
 “ dered some neighbouring hive: but if they did, they must have
 “ gone a great way for it; there not being any hives near that had
 “ been robbed.

“ The nature of the seasons has a great effect on the labour of the
 “ bees, with regard to their success; and of this the proprietor
 “ should

“ should be able to judge : for though their hives may be changed
“ three times in favourable years ; the seasons may be such in other
“ years, that they cannot be changed more than once. This dif-
“ ference should also be attended to in choosing their pasture : for
“ instance, if the summer is wet, shady and watery places should
“ be avoided, because there the bees themselves would be in danger
“ of being destroyed by the wateriness of the honey. On the other
“ hand, these are the best situations in dry years, when all the
“ flowers are parched up in places exposed to the sun. Sudden and
“ unforeseen changes may deceive the most intelligent husbandman ;
“ and in that case he should give his bees a supply proportioned to
“ their exigencies.

“ It sometimes happens that when some hives are quite full of
“ honey, we find others almost empty. We call these last *degene-*
“ *rated hives*, the bees of which work only to live. This inaction
“ of the bees is generally a sign that their queen is dead. In this
“ case, if the hive is weak in bees, it is added to a strong one ; but if
“ it is strong in bees, a weak hive is added to it : or an old hive
“ may be examined, to see whether there be not in it a young queen
“ to spare ; by this means the activity of the bees is generally re-
“ stored. Some hives degenerate when full of combs and honey ;
“ not for want of a queen ; but because the bees, content with
“ their store, indulge themselves in idleness. In this case, they may
“ be put into another hive, if the season is yet favourable ; or the
“ combs may be cut off within four or five inches of the top of the
“ hive. If they are not set to work by these means, it is a sure sign
“ that the queen is dead.

“ I shall close this account with the relation of a fact which
“ happened to a clergyman in the neighbourhood of Penthiviers.
“ He set a well stocked hive of bees upon a tub turned bottom up,
“ after having made a hole through that bottom. The bees made
“ in this tub combs so large, that their cells resembled quills. It
“ contained

“ contained near six pounds of wax, and four hundred and twenty
 “ pounds of honey. This was a great deal: for our best hives
 “ weigh but from eighty to an hundred pounds, and contain only
 “ from two pounds to two pounds and an half of wax, and about
 “ seventy pounds of honey.”

Mr. Boswell, p. 48. informs us, that there is a vast quantity of honey produced in Corsica: for the island has from the earliest times been remarkable for its swarms of bees. When it was subject to the Romans, a tribute was imposed upon it of no less than two hundred thousand pounds of wax yearly. Indeed the laurel, the almond-tree, and the myrtle, in the flowers of which the bees find so much sweetness, are very common here; and the hills are all covered with wild thyme and other fragrant herbs.

P. 280. These fathers have between thirty and forty bee-hives, in long wooden cases or trunks of trees, with a covering of the bark of the cork-tree. When they want honey, they burn a little juniper-wood, the smoke of which makes the bees retire. They then take an iron instrument, with a sharp-edged crook at one end of it, and bring out the greatest part of the honey-comb; leaving only a little for the bees, who work the case full again. By taking the honey in this way, they never kill a bee.

It appears from the account of the management of bees in my hives, that there is very little art wanting to cause the bees to quit the hives which are taken away, unless a queen happens by chance to be among them. In that case the same means may be used as are necessary when we would rob one of the common hives of part of their wealth. The method is as follows:

Remove the hive from which you would take the wax and honey into a room, into which admit but little light, that it may at first appear to the bees, as if it was late in the evening. Gently invert the
 hive,

hive, placing it between the frames of a chair, or other steady support, and cover it with an empty hive, keeping that side of the empty hive raised a little, which is next the window, to give the bees sufficient light to get up into it. While you hold the empty hive steadily supported on the edge of the full hive, between your side and your left arm, keep striking with the other hand all round the full hive from top to bottom, in the manner of beating a drum, so that the bees may be frightened by the continued noise from all quarters; and they will in consequence mount out of the full hive into the empty one. Repeat the strokes rather quick than strong round the hive, till all the bees are got out of it, which in general will be in about five minutes. It is to be observed, that the fuller the hive is of bees, the sooner they will have left it. As soon as a number of them have got into the empty hive, it should be raised a little from the full one, that the bees may not continue to run from the one to the other, but rather keep ascending upon one another.

So soon as all the bees are out of the full hive, the hive in which the bees are must be placed on the stand from which the other hive was taken, in order to receive the absent bees as they return from the fields.

If this is done early in the season, the operator should examine the royal cells, that any of them that have young in them may be saved, as well as the combs which have young bees in them, which should on no account be touched, though by sparing them, a good deal of honey be left behind. Then take out the other combs, with a long, broad and pliable knife, such as the apothecaries make use of. The combs should be cut from the sides and crown as clean as possible, to save the future labour of the bees, who must lick up the honey spilt, and remove every remains of wax: and then the sides of the hive should be scraped with a table-spoon, to clear away what

was left by the knife. During the whole of this operation, the hive should be placed inclined to the side from which the combs are taken, that the honey which is spilt may not daub the remaining combs. If some combs were unavoidably taken away, in which there are young bees, the parts of the combs in which they are should be returned into the hive, and secured by sticks in the best manner possible. Place the hive then for some time upright, that any remaining honey may drain out. If the combs are built in a direction opposite to the entrance, or at right angles with it, the combs which are the furthest from the entrance are to be preferred; because there they are best stored with honey, and have the fewest young bees in them.

Having thus finished taking the wax and honey, the next business is to return the bees to their old hive; and for this purpose place a table covered with a clean cloth, near the stand, and giving the hive in which the bees are a sudden shake, at the same time striking it pretty forcibly, the bees will be shaken on the cloth. Put their own hive over them immediately, raised a little on one side, that the bees may the more easily enter, and when all are entered, place it on the stand as before. If the hive in which the bees are, be turned bottom uppermost, and their own hive be placed over it, the bees will immediately ascend into it, especially if the lower hive is struck on the sides to alarm them.

As the chief object of the bees during the spring and beginning of the summer, is the propagation of their kind; honey during that time is not collected in such quantity as it is afterwards: and on this account it is scarcely worth while to rob a hive before the latter end of June; nor is it safe to do it after the middle of July, lest rainy weather may prevent their restoring the combs they have lost, and laying in a stock of honey sufficient for the winter, unless there is a chance of carrying them to a rich pasture.

When

When we have reviewed the various means made use of both by the antients and moderns in taking honey, it appears somewhat surprising, that a method so simple as the above did not occur to them : and especially that M. de Reaumur did not think of extending to general use, what he had frequently practised in the course of his experiments. It seems he did not reflect on the effects of the fear impressed on the bees by the continued noise, and how subservient it renders them to our wills : indeed to such a degree, that afford them but a quiet retreat, they will remain long attached to any place they are settled upon ; and will become so mild and tractable, that they will bear any handling which does not hurt them, without the least shew of resentment. On these occasions their only desire seems to be a wish to avoid such another disturbance as has reduced them to their present forlorn state. A person who has familiarized himself to bees, can by means of the passion of fear thus impressed upon them, and by that dexterity in the management of them, which can only be acquired by practice ; I say, such a person can, in this situation, manage the bees as he pleases.

Spectators wonder at my attaching the bees to different parts of my body, and wish much to be possessed of the secret means by which I do it. I have unwarily promised to reveal it ; and am therefore under a necessity of performing that promise : but while I declare that their fear, and the queen, are my chief agents in these operations, I must warn my readers that there is an art necessary to perform it, namely practice, which I cannot convey to them and which they cannot speedily attain ; yet till this art is attained, the destruction of many hives of bees must be the consequence ; as every one will find on their first attempt to perform it.

Long experience has taught me, that as soon as I turn up a hive, and give it some taps on the sides and bottom, the queen immediately appears, to know the cause of this alarm : but soon retires again among her people. Being accustomed to see her so often, I

readily perceive her at the first glance; and long practice has enabled me to seize her instantly, with a tenderness that does not in the least endanger her person. This is of the utmost importance: for the least injury done to her brings immediate destruction to the hive, if you have not a spare queen to put in her place, as I have too often experienced in my first attempts. When possessed of her, I can without injury to her, or exciting that degree of resentment that may tempt her to sting me, slip her into my other hand, and, returning the hive to its place, hold her there, till the bees missing her, are all on wing, and in the utmost confusion. When the bees are thus distressed, I place the queen wherever I would have the bees to settle. The moment a few of them discover her, they give notice to those near them, and these to the rest; the knowledge of which soon becomes so general, that in a few minutes they all collect themselves round her; and are so happy in having recovered this sole support of their state, that they will long remain quiet in their situation. Nay, the scent of her body is so attractive of them, that the slightest touch of her, along any place or substance, will attach the bees to it, and induce them to pursue any path she takes.

My attachment to the queen, and my tender regard for her precious life, makes me most ardently wish that I might here close the detail of this operation, which I am afraid, when attempted by unskilful hands, will cost many of their lives; but my love of truth forces me to declare, that by practice I am arrived at so much dexterity in the management of her, that I can, without hurt to her, tie a thread of silk round her body, and thus confine her to any part in which she might not naturally wish to remain: or I sometimes use the less dangerous way, of clipping her wings on one side.

I shall conclude this account in the manner of C. FURIUS CRE-
SINUS, *who being cited before the Curule Edile, and an assembly of the
people, to answer to a charge of sorcery, founded on his reaping much*
larger

larger crops, from his small spot of ground, than his neighbours did from their extensive fields; produced his strong implements of husbandry, his well fed oxen, and a hale young woman, his daughter; and, pointing to them, said, THESE! ROMANS, ARE MY INSTRUMENTS OF WITCHCRAFT: BUT I CANNOT SHEW YOU MY TOIL, MY SWEATS AND ANXIOUS CARES. So may I say, THESE, BRITONS! ARE MY INSTRUMENTS OF WITHCRAFT; BUT I CANNOT SHEW YOU MY HOURS OF ATTENTION TO THIS SUBJECT. MY ANXIETY AND CARE FOR THESE USEFUL INSECTS; NOR CAN I COMMUNICATE TO YOU MY EXPERIENCE, ACQUIRED DURING A COURSE OF YEARS.*

* Plin. Hist. Nat. Lib. xviii. c. 6.

CHAP. VI.

Of separating the honey and wax.

IN order to separate the honey from the wax, the combs should be laid in a place perfectly secure from the access of bees; for otherwise the bees would not only carry off much honey, but also be extremely troublesome, by stinging the people at work. It is proper to burn cow-dung or rotten hay at the doors and windows of this place; because the smell of the smoke arising from thence is so disagreeable to the bees, that it will drive them away. If the combs are taken out of the hive before the end of autumn, there are generally young bees in them. The parts of the combs in which these are should be laid aside, for they would give a bad taste to the honey. The bee-bread must also be separated, and both should be melted with the wax.

Before the combs are laid to drain out their honey, they should be carefully cleaned of every sort of filth, or insects. The crust with which the bees cover the honey in them should then be pared off with a sharp thin broad knife, and the combs themselves should be divided through the middle, in such manner as to render the cells open at both ends, that the honey may flow the more freely out of them. The combs should be laid in this state on sieves, or some other contrivance which will afford the honey a free passage. It will run quite clear; and the honey thus obtained should be kept by itself, as being the purest and best.

The combs which are but partly filled, and also those that were full and have done running, are broken by hand, and the honey in them runs out. Some put the broken combs into a strong bag, and then use a press to squeeze the honey out of them; and even warm the broken combs with the help of fire: but neither of these last consider that, in both these ways, much of the wax passes through the bag

bag with the honey, and that the wax being of greater value than the honey, the owner sustains a loss in that respect, besides that his honey becomes the less valuable, in proportion to its being less pure. It is true, that great part of the wax thus mixed with the honey soon rises to the surface, and may be taken off, especially after the honey is grown hard.

The makers of mead need not be extremely solicitous about separating the honey so very perfectly from the wax, because, by washing the wax in cold water, the honey will dissolve in the water, and the wax being strained from it by running the water through a coarse cloth, neither bad taste nor impurity will be communicated by it to the water, which may afterwards be used for making mead. The wax that has been skimmed off the honey separated by pressure, should be washed in the same manner; because, by this means, no part of the wax will be lost.

The goodness and flavour of honey depend on the fragrance of the plants from which the bees collect it: and hence it is that the honey of different places is held in different degrees of estimation. That which is made early in the year is also preferred to what is collected in the latter end of the season. The colour also depends on the colour of juices which the bees collect. Thus the honey from trees is higher coloured than from flowers, and from heath darker coloured than from almost any other flower.

In order to obtain the wax in a pure state, what remains of the combs after separating the honey, together with the combs which contain bee-bread, and young bees or maggots, is put into a copper with a sufficient quantity of clean water, which is made to boil over a slow fire, and stirred frequently with a stick. When the wax is melted, it is run through bags, which are put into a press, to separate the wax perfectly. The wax runs from the press into a vessel placed underneath, with some water in it, to prevent the wax from sticking to it.

What

What remains after the pressure may be again boiled in water, in order to obtain more wax from it: and this should be repeated by slow boilings, rather than by boiling it strongly at once.

All the wax that can be possibly obtained by these means, should be put into a vessel with some water in it, and be melted. It should then be let stand as long as it remains in a fluid state, that whatever impurities are in it, may settle in the water. The clean wax should then be poured off into a vessel, which shall give it the form it is to remain in, as long as it run clear, there being some water in the vessel, which will render the taking the wax out the more easy. The vessel is then carried into a place where the wax may cool gradually. It is found that, the larger the cakes of wax are, the better the wax keeps, and the higher price it brings; also, that the more gently it has been boiled the better it likewise is: for too hasty boiling renders it hard, and this increases the difficulty of bleaching it. The remaining wax should be strained through a cloth, to separate the remaining filth from it, and being again melted, is poured off as before. This second melting renders the wax much purer, and it will become more valuable to the manufacturer, because he is saved the trouble of purifying it.

CHAP. VII.

Of discovering bees in woods or buildings, and putting them
into hives.

APRIL, when the willow is in bloom, or May, when the white thorn blossoms, is a proper season for discovering the abode of bees in woods, or near any place where there is plenty of flowers. It is proper to observe early in the morning, whether many or few frequent these places: if but few, their abode is distant, or their whole stock is not numerous: but if they appear in numbers, there is the greater room for hope to find their habitation.

Their return to springs being frequent, you may use the following method to discover the distance at which they live from the spring. Have by you some oker dissolved in water, and wet in this some stalks of grass, with which touch the bees on the back when they come. By their being thus marked, you will be able to judge whether they return soon: if they do, it is a sign that their home is not far off; and by the time they take to appear again, you will be able to judge at what distance it is. If they return soon, you may perhaps follow them to their place of resort.

If the bees come from afar off, more skill is requisite to discover their dwelling; and in this case, the following method may be used. Cut an entire joint off a large reed, with the knot at one end; bore a hole in the side of it, and through this drop some honey into its inside; then lay it near the spring or other resort of the bees. When the smell of the honey has inticed some of them into it, take it up, clapping your thumb on the orifice, and let go one of the bees, which pursue as long as you can keep sight of it. When you have lost sight of it, let another fly; and if it follows the same course, continue the pursuit. By this means you will be led to their abode. If any of the bees take a different course, let another
Q fly,

fly, and so on, till you find one take the same course as the first: or if you find two or more fly the same way, though different from that of the first, pursue them.

Some rub hives with aromatic plants agreeable to bees, and then with honey; after which they place them near to springs or other places that bees resort to, especially about their time of swarming. The bees, thus allured, settle sometimes in these hives, which are afterwards carried home.

If the bees are found in the hollow of a tree, or if a swarm escapes and settles in the hollow of a tree, and have remained there long enough to have made combs; by striking the out-side of the tree, you may guess by the sound, and humming of the bees, how far the hollow reaches. With a chissel and mallet cut a hole in the tree, as near as can be to the upper part of the hollow. Then continue striking the tree all around, and the noise will so frighten the bees, that they will all come forth. If an empty hive is kept by the edge of the hole, they may enter into it, and if not, they will settle on some branch of a tree, from which they may be put into a hive. If they still continue in the tree, they will be so frightened by the continued noise, that the combs may be taken out comb by comb. As the combs are taken out, they are put into a hive covered with a cloth and carried into a room. There the bees are brushed off the combs upon the cloth, and put into an empty hive. The combs are then examined, and such as have young bees, or bee-bread in them, should be fixed in another hive, and the bees put to them. In case any bees remain still in the hollow of the tree, set fire to some cow-dung, and let the smoke enter at the lower opening of the hollow, it will oblige them to fly out at the upper hole which was made. They will soon gather in clusters on the branches of the trees. The hive in which the bees are may be then brought out, and placed near the tree, one side being raised, to give an easy admission to the stragglers, and to the bees settled on the branches of the trees, who will soon join their companions. To

prevent their ever thinking of returning to the tree again, the hollow should be stuffed with nettles, or other plants disagreeable to bees.

If the bees are in the hollow of a wall, strike it with a hammer, listening whence the sound comes, that a hole may be made as near the upper part of their works as may be. Treat the bees and combs as in the former case, and as before shut up the holes with nettles to prevent their settling or returning to that place.

When this is done at a season of the year in which the fields yield plenty of food, it is only necessary to put in the empty hive such parts of the combs as have young in them, and the bees will soon collect fresh store for themselves. But if done late in the season, when it may be feared they cannot collect a fresh supply, the combs should be taken out as intire as possible, and being cut as near the shape of a hive as can be, they should be secured in it, the part of the combs containing the honey being placed at the crown of the hive. Let the hive then stand a while, that the honey in the cells which have been cut or opened, may drain out; then the bees may be put into the hive, and they will soon repair their combs, and be thus enabled to stand the winter. If the owner has a store-hive of honey, such as I have directed, the bees may be at once put into it, and the honey taken out of the tree or wall may be turned to use. Particular care must be taken in this operation, that there is a queen with the bees; if there is not, a queen must be given them.

CHAP. VIII.

Of Enemies to bees.

THE proprietor having provided for his bees as great plenty of pasture as he possibly can, should next be as careful to guard them from the many enemies which either annoy or seek to prey upon them. These are of three sorts. The first are weak harmless insects, which creep into a hive, without well knowing whither they are going, and only raise disturbances and confusion in it: the second endeavour to destroy the bees, and eat up their honey; and the mischief of the last is levelled only at their wax.

In the first class, we may reckon flugs and snails. Spiders seem hardly to deserve being ranked among the enemies to bees, because their webs are too weak to entangle a bee. Ants sometimes make their nests in the coverings of hives, without molesting or being molested. There is a little insect which adheres to bees, and probably lives by sucking their bodies. It is of a red colour, and of the size of a very small pin's head. It is usually found sticking to the breast of the bee. The young bees are never troubled with these lice or vermin, which prey upon none but the old ones; nor have these generally more than one louse upon them. These lice are oftener found upon bees which inhabit old hives, where they have had time to multiply, than upon the tenants of a new one.

Millepedes, or wood-lice, are a most destructive enemy to bees. They often proceed from the stands being made of old decayed wood, in which the wood-lice lay their eggs, and thus breed under the very hive: or enter the hive when it is placed near a dry hedge, or old building, in which these lice harbour, and entering the hive, breed in the combs. They enter the hive during the cold of the winter and spring, eat the honey, and destroy all their works. The remedy consists in guarding against their first attack, by making the

stands

stands of new wood, spreading foot mixed with barley-chaff on the ground under the hive, and by a proper situation.

Several birds are numbered in the second class. Sparrows make great havock amongst bees, especially in the spring, in order to feed their young. Swallows are also mentioned in this light. The house-lark, a little dun bird with a black bill, is a great destroyer of bees. The only remedy here is, to destroy the birds, and hire boys to rob their nests. Traps to catch birds, being baited with dead bees, may be placed near the hives. Hornets and wasps, and especially the species of wasps which are scarcely larger than bees, are very formidable enemies; for they seize a bee loaded with honey, kill him instantly, and suck out the honey. If this robbery is committed near the mouth of the hive, they carry off the bee to a place of greater safety. Their nests should therefore be carefully destroyed. Columella advises*, that the hive have two or three openings at some distance from each other, to guard against the craft of the lizard, who, gaping for his prey, destroys the bees as they go forth.

The field-mouse is an enemy to be carefully guarded against as soon as the cold begins to approach: for if it enters at that season it makes dreadful havock. At first it destroys the lowest parts of the combs; but as the weather grows colder, and the bees more torpid, it ascends up the hive, and seizes on the richest treasure: nor does the evil end here: for other bees, smelling the honey spilt by the mouse, fall upon the hive, and rob it of what remained; or as soon as the warm weather returns, and the bees stir about, they are sometimes so disgusted at the havock made by the mouse, that they desert the hive. The only way to guard against this, is to prevent its entering into a hive. Whilst the bees continue in their vigorous state, it dares not attempt them: therefore, as soon as the cold approaches, the entrance to the hives should be lessened. If the hives

* Lib. ix. c. 7.

are thatched, they should be examined from time to time, to see that none of these mice nestle in the thatch, through which they would by degrees eat themselves a passage into the hive.

Bees may themselves be reckoned enemies to bees: for they sometimes wage cruel wars against each other. Their fighting and plundering one another ought chiefly to be imputed to their insatiable thirst for honey: for when, in spring or autumn, the weather is fair, but no honey can be collected from plants, and is to be found only in the hives of other bees, they will venture their lives to get it there.

Dr. Warder * assigns another cause of their fighting, which is, the necessity that the bees are reduced to when their own hive has been plundered, at a season when it is too late for them to repair the loss by any industry in the fields.

Sometimes one of the queens is killed in battle. In this case, the bees of both hives unite as soon as her death is generally known among them. All then become one people; the vanquished go off with the robbers, richly laden with their own spoils, and return every day, with their new associates, to pillage their old habitation. This causes a throng unusual for the season, at the door of the hive they are plundering; and if the owner lifts it up at night, when all are gone home, he will find it empty of inhabitants; though there perhaps will remain in it some honey, which he takes as his property.

When two swarms take flight at the same time, they sometimes quarrel, and great numbers are destroyed on both sides, till one of the queens is slain. This ends the contest, and the bees of both sides unite under the surviving sovereign.

Robbers make their attacks chiefly in the latter end of July and in the month of August. They appear to act with caution at first,

* P. 126.

and to procure themselves an entrance by stealth; not pitching boldly like the native bees, and then entering at once in at the door. If they are encouraged by success, they return in greater parties, sometimes all the bees of a hive, and endeavour to force that entrance which they fought before with so much caution. They come in such numbers, as frequently to make those who are not acquainted with these scenes, mistake them for new swarms: but the number of dead bees strewed on the ground, soon convinces them of this error.

The most effectual way to prevent the loss of bees, as well as of honey, occasioned by those robberies, is, early in the autumn to shorten the entrance into the hive, so as to leave room for only two or three bees to pass a-breast. The bees will be much better able to defend this reduced entrance, than if it were larger. If, notwithstanding this narrowness of the passage, robbers attack a hive, the entrance should instantly be almost intirely shut up, and kept so till the thieves are gone; though many of the bees then out, and fighting in defence of their habitations, must be thereby sacrificed to the safety of the rest. The entrance should be again opened as soon as the coast is clear; and it will be adviseable in the evening to examine the state of the hive, especially as to weight, lest these plunderers should have been at it before, and thereby have brought it low. In this case, it will be better to take what remains, than to run the hazard of losing the whole: but if it feels heavy, the entrance should have only a passage for air, none for bees; and every crevice around the hive should be closed up with equal care, not only to guard against the attacks of their enemies, but to keep the bees themselves from going out. If but a few robbers appear, the bees of the hive should be put on their guard, by irritating them with some plant offensive to them; for they will instantly seize the robbers, and execute due vengeance on them. The person who is thus employed at a time when all the bees are full of resentment, should himself be well defended from their stings.

In the third class of enemies to bees is a small caterpillar, termed the wax-worm, or wax-moth, because of the havock it makes on wax. It is tender in its frame, unarmed and defenceless; and yet can subsist itself in the midst, and at the cost, of the most numerous hive. A few of these little caterpillars will destroy and break to pieces the combs of a hive, build up new edifices for lodging themselves in it, and finally force the bees to quit the place.

This insect is of the species of the false-moth, and is extremely nimble. It is enough for it to get into a hive unawares. It runs so very swiftly, that it passes unperceived, and slides into some narrow place between the combs, perhaps inaccessible to bees, there to lay its eggs in security. This done, it makes its escape as well as it can. From each of these eggs proceeds a caterpillar, which escapes certain death merely by its extreme smallness, and the quickness with which it spins and enwraps itself in a covering sufficient to secure it from all harm. This covering, or tube, is glued to the wax which the caterpillar feeds on, and this insect lengthens the tube as it eats the wax, till at last it shuts itself up in order to be transformed into a chrysalis. Several caterpillars, and consequently several moths, must proceed from the eggs which the males and females engender. Probably the bees destroy great numbers of the moths: however, if a single female has an opportunity to lay her eggs, she is so exceedingly prolific, that this second brood may quite overspread the hive. If one of the impregnated females escapes out of the hive by means of her great nimbleness, she seeks out another hive, in which she spreads the same source of mischief.

When we consider how great damage this moth in particular, and other insects which frequently find means to creep into the hive, do to the combs of the bees; we shall find the Romans judged very rightly in cleaning their hives; of the manner of doing which, Columella speaks to the following purport *.

* Lib. ix. c. 14.

“ The hives should be first cured by opening them in the spring,
“ in order that all the filth which has gathered in them during the
“ winter, may be removed. Spiders, which spoil the combs, and
“ these small worms, or rather caterpillars, from which the moths
“ proceed, must be killed. When the hive has been thus cleaned,
“ the bees will apply themselves to work with the greater diligence
“ and resolution. From the summer solstice to the autumnal equi-
“ nox, the hives should be opened, cleaned, and smoaked, every
“ tenth day, and then washed and cooled with cold spring-water ; and
“ what impurities cannot be washed away, should be wiped off
“ with the pinion of a sufficiently strong wing. Particular care must
“ be taken to sweep out every caterpillar that can be seen, and to
“ destroy all the moths. To this end, a vessel with a narrow neck
“ increasing gradually to a wide mouth, with a light in the neck,
“ should be placed under the hive, in the evening. The moths,
“ gathering from all parts around this light, are, in that narrow
“ space, scorched and killed.”

If the hive attacked is weak, it will be adviseable to strengthen it, by the addition of another weak hive ; or rather to add the bees of this hive to another which wants numbers, especially if the other hive stands at some distance. If the hive attacked has a due proportion of bees, at the same time that the entrance is narrowed, the hive should be removed to another garden at some distance ; if half a mile, the better. The entrances of all the hives should be narrowed, lest the robbers missing the hive they had fell upon, attack another.

The best method of uniting the bees of different hives at this season is, to take the bees out of both hives as already directed, then to strike the bees of one of the hives upon a cloth, take away their queen, and immediately place over them the hive in which the bees taken out of the other hive are, that they may unite while thus in fear and distress, which they will now do without fighting, as they would be apt to do, if strange bees were added to a hive possessed of

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their honey. When united and quiet, the hive with honey in which they are to remain is put over them, and they will soon ascend into it.

In regard to the enemies to bees, it will plainly appear, that the use of my hives will be the greatest security against them, especially against such creatures as make a lasting settlement in the hive, such the moth, wood-lice, &c. for as the hives are so often changed, the enemies are dislodged before they can well make their quarters good. And if every other means of defence I have proposed are put in practice, the bees will run very little risk.

CHAP. IX.

Of the diseases of bees.

MADAM Vicat, already so justly commended, has published in the Memoirs of the Society of Berne, for the year 1764, extremely judicious observations on bees, and on every inconveniency they are liable to. Her remarks will deserve our attention; and I shall give them nearly as related by herself.

On the 9th of June 1761, this lady bought an hive of bees, in a straw hive. The combs were emptied of their honey, and thereby rendered the more liable to be attacked by the moth. She placed it in a little garden in the heart of the city of Laufanne. She soon discovered that there were moths in it, and that the bees had lice on them; which determined her to place a glass hive over the straw one, and to shut up the opening into the lower hive. She frequently looked into the glass hive, to see what passed in it. The bees never stopped in it, and it served only as a thoroughfare to the straw hive. The bees, though very laborious and numerous, could not defend themselves against the moths, which multiplied daily: On the 18th of July her bees were reduced to little more than three hundred. Finding their number decrease every day, she suspected that some accident had happened to the queen, which upon examination she found to be true; as she also did, that these moths may soon destroy the most numerous hive. They had mouldered away the wax, and had united the three middle combs, by their galleries, to such a degree, that they appeared but as one mass. Upon turning up the hive, to see what condition it was in, she found the sides covered with white and hard cocoons, which would soon produce moths. They were in such quantity as to fill the crown of her hat.

It appears to her that the moths are most ready to attack hives which have swarmed oftener than once; because in them the

combs, in which the young bees were reared, being empty, serve for both shelter and food to their maggots, which feed only on wax. For the same reason, late swarms, and hives in which there is not much honey, are equally exposed to these insects. Such hives should therefore be cleaned at least once a week. If moths are found on the stool of the hive, it should be cleaned every morning. In order to do this the more easily, without disturbing the bees, or running the hazard of being stung by them, she caused a large square hole to be made in the stools on which her bees stand, with a slider underneath, fitted to 't. By this means she preserved another hive, which she had placed in the same garden on the same day, June 9, 1761: and though it was a swarm put into a new straw hive, she observed moths in it by the end of July. She calls this hive N^o. 1.

When she secured this hive for the winter, she put it into a dry room: but the air there being too mild, the bees consumed almost their whole store. She drew the slider often; for the disaster which had happened to her other hive rendered her now more attentive; and she generally found a quantity of moths on it. The combs became mouldy, which she endeavoured to wipe off with soft brown paper, and rubbed it off the sides of the hive with a napkin. So many bees died during the winter, that the hive became very weak in comparison to what it was in the autumn. About the middle of March, she placed it in a little garden surrounded with houses.

She placed near the former a swarm of June 1761, which had been kept in a hive of Mr. Paltau's construction*, and had stood the preceding summer in the country, and the winter in a greenhouse in town, where the air was constantly kept temperate. Few of these bees died. She calls this hive N^o. 2.

That she might judge of the strength of these hives, she counted the bees which entered into each of them in a quarter of an hour;

* Described in a work intitled *Nouvelle Construction de Ruches*, printed at Mentz in 1756. 8vo. p. 316.

taking the same hour of a fine day. She repeated this during several weeks, and found that about six hundred and sixty entered in N^o. 2, and two hundred, or sometimes two hundred and twenty, in the same time, into N^o. 1.

In May, the numbers of bees were so much increased, that it was no longer possible to count them. N^o. 1. was now as well stocked with bees as N^o. 2. She had been particularly careful of the former, and had fed them with honey in rainy weather. She had cleaned the slider every morning, and often found on it even four moths at a time. She thinks that the bees can easily pull them out of their holes before their galleries have been strengthened with cross threads, and cemented with the crumbs of wax or their excrements. The bees do not always carry them out of the hive, but sometimes leave them on the stool, where the little maggots soon weave a case to conceal themselves in; as she has known them do in a few hours. She found the greatest number of them at about four or five o'clock in the morning.

She resolved to place over N^o. 1. a glass hive, to give the bees an opportunity of working in it. With this view, she cut some rounds off the top of the straw hive, so as to make an opening of four inches, upon which she put a piece of board with a corresponding opening of four inches; and on the 25th of March 1762, a glass hive was placed over it. She shut up the mouth of the straw hive, in order to oblige the bees to enter by an opening under the glass hive, which she covered, lest the cold might incommode or even kill her bees, which were few in number. Tho' they increased so much by May as to be equal with N^o 2. yet the bees never stopped in the glass hive. She judged from this, that they would rather descend, if she gave them a convenient habitation below. She therefore placed under the straw hive a box, which had an opening in it of eight inches, for the bees to pass through. They soon extended their works downward, so that in a fortnight they almost filled the box with combs.

combs. On the 8th of July she took away the glass hive; and though it had hitherto served them only as a passage, they were much disconcerted when it was removed: for after she had filled up the opening in the top of the straw hive with flax and rue, the loaded bees continued for several days to fly round it, though the rue was disagreeable to them, before they would enter by the opening in the box, which was the only one they now had.

It is very remarkable, that the bees made no combs in the glass hive, though they were so fond of entering by it; and yet they descended into the box as soon as it was placed under them. We might have imagined it to be easiest for them to enter below, at the bottom of the box; but instead of so doing, they entered by the glass hive, passed through the straw hive full of combs, and carried their load down into the box. This gave her the first hint, that it was most adviseable to put the additional hive into which we would have the bees to work, under the full one, and she has since found it succeed accordingly.

On the 20th of July, she found that the bees of N°. 1. had cast out so great a quantity of their young brood, that she gathered some handfuls of it about the hive. The bees continuing to do the same next day, she determined to take away the straw hive the day after. For this purpose, she chose eight o'clock in the morning, which she had observed to be the time when the greatest number of bees were gone into the fields. She began by loosening the straw hive from the board on which it rested, and to which the bees had fastened it with propolis. She then took the wadding out of the hole in the top of the straw hive; near to which some linen rags were kept smoking, and this smoke was blown into the hive by a pair of bellows. As soon as she judged that most of the bees had been forced down into the box, she caused a strong iron wire to be drawn thro' between the hive and the board it rested on, thereby to cut transversely all the combs which were extended from the hive into the box thro' the hole of communication. The hive was then taken
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up with all the combs but one, which separated from the middle of the hive. She carried this comb, with two fingers of each hand, to a table at some distance, on which the hive had been placed bottom up. The comb which she carried was almost covered with bees; and as it fell from the middle of the hive, where the queen generally resides, she searched for her, and found her on the first round of the hive, scarce able to crawl, being daubed with honey which had flowed from the combs cut through. She washed her in a glass of water; but finding that this did not entirely carry off the honey which still adhered to her wings, she washed her a second time, and put her among several bees which had also been washed, but had recovered strength enough to assist their queen. They immediately set themselves to dry and assist her. She kept her thus for half an hour, in the presence of several curious persons, who had often sought in vain for her. As soon as she thought her able to make use of her legs and wings, she carried her to the stool on which the box remained, now to become the only habitation of the bees. Here she was again brushed and licked during an hour, by bees which were in great numbers on the fore part of the box, and at last she entered.

A farmer with whom this lady kept some bees in the country had an old straw hive, which he intended to destroy in order to come at their honey and wax. She proposed to him to follow the same steps as she had taken with her's, which he agreed to, knowing that he could not lose any thing by it. Having been taught by experience, she advised him to put a box under the hive; rather than a hive over it. As she had observed that her own bees had so obstinately adhered to their former passage, she advised him to place the box at a small distance from the place where the hive had stood, that the whole might be the newer to them. They set to work heartily on the 3d of July; and by the 16th of August they had lain in so much provision, that she determined to take off the hive in the same man-

ner as she had done her own. The honey did not run so much, because the weather was not so hot.

Whatever pains are taken to drive the bees out of the hive by means of smoke, many still remain in it. In order to preserve these bees, she found that the best way was to sweep them with the wing of a fowl into a tub of water, as fast as the combs were taken out. This practice was attended with several advantages. It prevented the people being stung, it cleared the bees of any honey that might have dropped on them, and it made many of their lice fall off them.

In order to take them out of the water, she caused a thin linen cloth to be spread over the mouth of an empty tub, in such manner that it hung every where over the brim, and was held there by one person, whilst another poured the water in which the bees were gradually through it. The bees remained on the cloth. It is essential that the quantity of water be large in proportion to the number of bees, and that they be quite senseless before they are taken out. If the first water tastes of honey, they should be bathed in a second quantity. M. de Reaumur * lost many bees by not attending to this precaution †. When the bees have been sufficiently bathed, Madam Vicat spreads them on whited-brown paper, which, with the warm air, soon dries them.

* Memoires pour servir à l'Histoire Naturelle des Insects, tom. v. p. 560.

† As an instance how long some insects may retain life when immersed in a fluid, I have been assured by a very ingenious and accurate gentleman, that, being present at the opening of a bottle of Madeira wine which had been brought from Virginia to London, three flies were found in it. He immediately observed, that they had a fair opportunity of trying the truth of the common opinion, that a fly cannot be drowned; and desired the company to lay the flies in the sun, the day being very warm. The flies were accordingly laid on a china plate, and in less than an hour two took wing. M. de Reaumur kept bees under water during nine hours, and all of them came to life. Tom. v. p. 540. They have remained twenty-four hours under an exhausted air-pump, and revived. Derham's Physico-Theology, book I. chap. i.

It was some time before this lady could find the queen of the farmer's hive. The country people who saw this operation, were struck with great compassion on seeing so many bees laid out, as it were, upon the table; for they thought them quite dead, and could not believe her when she assured them that they would all return to life. By the time she had found the queen, many of the bees had so far recovered, as to take care of her. Madam Vicat observed on her crocelet a louse, which she struck off with a pin. She saw a second on the hind part of her head; but it stuck so fast that she could not remove it; nor was she much solicitous about it, because the queen seemed to be in good plight. All the bees were placed on the stool before the box; and she was informed next day, that they had all soon returned to their companions. Having observed in the combs some cells which had young in them, she put an additional height under the box, in which she placed the combs with the young in them: and remarking on the 20th of August that there were several moths under the last addition, in which the combs with young were placed, she judged it not to be right to preserve such combs for the future. Experience has since confirmed her in this opinion.

It is generally alleged, that the moths get so much the upper hand in the hives by the fourth year, that it is necessary to destroy the bees on the third year, in order to get the then remaining honey and wax; for that all would otherwise fall a prey to the moths. Madam Vicat has now shewn, that hives may be preserved from moths without condemning to the fire those precious labourers, the bees; a practice as barbarous as it is senseless; a practice which was strictly forbidden by a Grand Duke of Tuscany, under the penalty of severe punishment, as we are informed by M. de Reaumur*. If care is not taken, even three years will be too long a time to allow; for the moths will frequently destroy a hive the very first year.

* Tom. v. p. 666.

The lice which stick to the bees are not generally thought to be prejudicial to them *; and this may be true when there are but few of those vermin; but when every bee in a hive has two or perhaps three lice upon it, as is often the case, we may believe that the bees are greatly incommoded by them: indeed we may be assured of it, by their using every means in their power, though ineffectually, to get rid of them. M. de Reaumur declares †, that he cannot think well of a hive in which the greatest number of bees have lice on them.

Madam Vicat had a hive near a chair in her garden, in which she used to sit at work for hours. She one day saw many bees endeavouring to rid themselves of these troublesome enemies, and endeavoured, but to little purpose, to assist them, by killing the lice with her scissars. Recollecting that tobacco is a poison to many insects, she immediately strewed a little Morocco tobacco over some bees which had lice on them. The lice fell off instantly, as dead. In order to be assured that tobacco did not hurt the bees, she confined some which were lousy, under a glass placed on paper strewed with tobacco. After the bees had passed several times over the tobacco, the lice fell off them dead. She left the bees in the glass three hours, and at the end of that time they appeared vigorous and well. She had bathed some bees in water, in order to rid them of the lice; but found that, though many of them fell off, they recovered themselves again as soon as the bees did. One of the lice jumped two inches high, to get at a bee which she held in her hand.

The farmer to whom she entrusts the care of her bees in the country lost a hive in the winter of 1763, in a manner that had never happened before. There was plenty of provision in the hive, and it was as well stocked with bees as any other. They did not

* Madam Vicat, in the Berne Memoirs above quoted, p. 135.

† Tom. v. p. 711.

die of cold, for the weather was warm, and they went abroad the day before their almost sudden destruction. Of eight hives which he had in another apiary, six perished in the same manner.

She had a glass hive, in which the number of bees was reduced in the spring to about four hundred. In order to strengthen it, she resolved to take about a thousand bees from one of the strongest hives, and to add them to this. She knew that bees, by being bathed together, are reconciled to one another as soon as they return to life; and therefore took the following method. She held the mouth of a wide-mouthed bottle to the opening of the strong hive, whilst, with the other hand, she gently struck the hive. Upon this, the bees issued into the bottle held close to the mouth of the hive; and as soon as she judged that a sufficient number of them had entered the bottle, she clapped a paper over the mouth, and held the bees prisoners. The bees in the glass hive were so much chilled by the cold of the night, that they easily fell down when the hive was struck, and were taken. After the bees had been a few minutes in the water, she spread them out on a brown paper to dry, and afterwards put them into a bag of clear sieve-cloth. It was not necessary to bathe the queen. She therefore secured her under a glass, with about a dozen of bees to keep her warm. The bees being all returned to life, she put the queen into the hive, and applying the mouth of the bag to the mouth of the hive, all the bees entered, and ranged themselves on the combs.

At night she drew out the slider in order to wipe the bottom of the hive. There she found a great deal of candied honey, and several bees which seemed to be expiring. In the morning, she found many more in the same situation, and knew not what to impute it to. This was on the 24th of March; and the weather was so cold, that the bees of her other hives did not go abroad. At eleven in the morning, she saw the queen in the midst of a group of bees on a comb. She could not conceive the meaning of a noise that was

frequently made in the hive. As soon as she heard this noise she approached, and was grieved to see numbers of bees fall to the bottom. They struggled as much as possible to get upon the combs, but could not.

She had never heard that candied honey is prejudicial to bees; yet could not account for this havock from any other cause: for the bees not being able to swallow the candied honey, emptied it out of the combs, in order to come at such as they could swallow. The candied honey falling on the bottom of the hive, the bees could not stir without daubing themselves in it. Their legs were clogged with it, and by their endeavours to rid one another of it, they daubed each other more. Their bodies were smeared with it, and their wings so loaded that they could not fly.

On the morning of the 25th, she searched in vain for the queen on the combs, where only a few bees now remained free from this misfortune. In general, the queen is the last that suffers any injury; by reason of the great care which the other bees take of her. Here, that very care became her destruction; for, all of them being more or less clogged with candied honey, their endeavours to help her served only to increase her already too great load. All attempts to relieve them were fruitless.

The honey does not candy every year: and even in the coldest weather this accident is not universal. Madam Vicat had an instance of it; for, in an apiary where there were a dozen of hives, only one perished; and in another where six perished, two remained safe. It seems always probable, that the honey candies when the weather changes suddenly from warm to cold. Whilst the weather continues cold, the bees remain in a lethargic state, eat none of it, and therefore do not then open any of the cells: but if there be returns of warm weather, they want food in this weather, and in this case they do open their cells. A sudden return of cold

congeals or candies the honey in these open cells. On the return of warm weather, the bees return to the cells they had opened, and finding there a substance which is too solid to pass into their stomachs, or which they cannot swallow, they throw it out of the cells, in search of good honey: the candied honey falls upon the stool, or bottom of the hive, and by this means they make their own graves. The ancients seem to have known that candied honey is prejudicial to bees. Virgil * cautions particularly against leaving an opening so large as to admit a degree of cold capable of congealing the honey.

Many hives of bees which are thought to die of cold in the winter, in truth die of famine; as was the case in the winter of 1759: for the constant rains of the preceding summer hindered the bees from laying in a sufficient store of provisions. The hives should be carefully examined in the autumn, and should then weigh at least eighteen pounds.

These observations of Madam Vicat's seem to account more rationally than any other reasons I have yet seen assigned, for a purging which writers speak of as incident to bees in the spring. Columella describes it † as an annual distemper which seizes them in the spring, when the spurge blossoms, and the elm discloses its seeds; for that the bees, being allured by the first flowers, feed so greedily upon them, that they surfeit themselves therewith, and die of a looseness if they are not speedily relieved. He relates Hyginus's advising, in this case, to cover the bees with ashes of the fig-tree; and affirms, that, being enlivened by the warmth of these ashes, the bees will

* ————— Nam Frigore Mella
Cogit hyems, eademque Calor liquefacta remittit,
Utraque vis Apibus pariter Metuenda —

I am of opinion that candied honey must be what has been too long in the combs, become sower and hard, and is usually called stone-honey. It is poison to the bees, and sometimes drives them from their hives.

† Lib. ix. c. 13.

revive in two hours, and go into a hive brought to them; Columella advises giving them rosemary and honey diluted with water. Aristomachus seems to have prescribed the most effectual cure, namely, to take away all the vitiated combs, that is, all the combs in which there are open cells appearing to contain candied honey.

The authors of the *Maison rustique* * impute this purging to the bees feeding on pure honey, which does not form a food sufficiently substantial for them, unless they have bee-bread to eat at the same time; and advise giving them a honey-comb taken from another hive, the cells of which are filled with crude wax, or bee-bread.

* Tom. i. part i. liv. v. c. i. p. 454. 7th Edit. 4to.

CHAP. X.

Of feeding Bees, and of the care of them during the Winter.

PROVIDENCE has ordained that insects which feed on leaves, flowers, and green succulent plants, are in an insensible or torpid state from the time that the winter's cold has deprived them of the means of subsistence. Thus the bees, during the winter, are in so lethargic a state, that little food supports them: but as the weather is very changeable, and every warm or sunny day revives them, and prompts them to return to exercise; food becomes necessary on these occasions. Mr. White is of opinion *, that a greater degree of cold than is commonly imagined to be proper for bees, is favourable to them in winter. If a sharp † frost continues for two or three months, without intermission, you may observe through your glass, that the bees are all this time closely linked together in clusters between the combs. If they are not altogether without motion, yet it is certain they stir not from their places, while the cold continues, and therefore eat not at all.

The following directions are given for feeding of bees in the *Maison rustique* ‡. Replenish the weak hives in September, with such a portion of combs full of honey, taken from other hives, as shall be judged to be a sufficient supply for them. In order to do this, turn up the weak hive, after taking the precaution of defending yourself with the smoke of rags, cut out the empty combs, and put the full ones in their place, where secure them with pieces of wood run a-cross, in such manner that they may not fall down when the hive is returned to its place. The bees will soon fix them more effectually. If this method be thought too troublesome, set under the hive a plate of liquid honey, unmixed with water, with straws

* P. 9.

† P. 10.

‡ Tom. i. part i. liv. v. c. 1. p. 435.

laid a-cross it, and over these a paper pierced full of holes, through which the bees will suck the honey without daubing themselves. This should be done in cloudy or rainy weather, when the bees stir least abroad; and the hive should be covered, to protect the bees from robbers, who might be allured to it by the smell of the honey.

Another circumstance which may render it very necessary to feed the bees, is, when several days of bad weather ensue immediately after they have swarmed; for then, being destitute of every supply beyond what they carried with them, they may be in great danger of being starved. In this case honey should be given them, in proportion to the duration of the bad weather.

The degree of cold which bees can endure has not been ascertained. We find that they live in the cold parts of Russia, and often in hollow trees, without any care being taken of them. Their hives are frequently made of the bark of trees, which does not afford them much protection from cold. Mr. White * therefore judiciously confirms Mr. Gedde's observation, that bees which stand on the north side of a building whose height intercepts the sun's beams all the winter, will waste less of their provisions (almost by half) than others which stand in the sun: for coming seldom forth, they eat little, and yet, in the spring, are as forward to work and swarm, as those which had twice as much honey in the autumn before. The owner should, however, examine their state in the winter, and if he finds that, instead of being clustered between the combs, they fall down in numbers on the stool or bottom of the hive, the hive should be carried to a warmer place, where they will soon recover. He must be cautious in returning them again to the cold, lest the honey be candied, as before observed.

Where the winters are extremely severe, the authors of the *Maison rustique* advise †, to lay on the bottom of an old cask the depth of

* P. 11.

† Tom. i. part 1. liv. v. c. 1. p. 441.

half a foot of very dry earth, powdered, and pressed down hard, and to set on this the stool with the hive; then, to preserve a communication with the air, which is absolutely necessary, to cut a hole in the cask, opposite to the mouth of the hive, and place a piece of reed, or of elder made hollow, from the mouth of the hive to the hole in the cask; and after this to cover the hive with more of the same dry earth. If there be any room to fear that the bees will not have a sufficiency of food, a plate with honey, covered as before directed, may be put under the hive. If the number of hives be great, boxes may be made of deals nailed together, deep enough to contain the hives when covered with dry earth. The bees will thus remain all the winter free from any danger from cold, hunger, or enemies.

Every hive should have at least twenty pounds of honey in it in the beginning of the winter. If short of that quantity, a reserved hive should be put to them, or they should be fed with clean honey, put into a pewter dish covered with paper, and put under the hive at night. For feeding bees in boxes, three or four pounds of honey should be put in the box, Fig. 4. Plate 11. already described. A piece of paper of the exact dimensions of the cavity of the box, pierced with holes, through which the bees may suck the honey, must be laid on the surface of the honey; and in the evening the entrance into this box being closely applied either to an opening made in the back of the lower part of the bee-boxes, and securely supported in that situation, or to the mouth of the bee-boxes, the bees will soon smell the honey, and carry it all off by morning. By this means, robbers are not tempted, indeed have no opportunity of annoying them, for the box is removed in the morning. If the first quantity is not deemed sufficient, the same may be repeated next night; for every wise man will take care that his bees be plentifully provided.

That bees suffer such degrees of cold, as we here are strangers to, without detriment, seems certain; nor is it easily accounted for,

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why a much less degree of cold becomes fatal to them in our mild climate. If I may venture my opinion, I think that in these extreme colds, the bees are so perfectly frozen that their juices cannot corrupt or putrify; but they remain in the same state till the return of spring; when the change of the weather being sudden, the bees soon come to life: whereas in our climate they are so far chilled, as to lose the signs of life, and their juices being still in a liquid state, soon putrify, and real death ensues with corruption, the stench of which proves destructive to the live bees, if the dead bodies remain long in the hive. It is therefore a good rule, to examine the hive from time to time, whether any bees fall to the bottom; that if they do, the seeming or real dead should be removed.

Hives should never be placed on stones, because they are susceptible of too much heat in the summer, and are so cold in the winter that it is an immediate death to every bee that lights on them. Even wood is then too cold; and therefore I would advise the owners of bees to have straw bottoms, in every respect similar to the straw covers already described, to be laid under the hive during the winter, that when the bees descend, they may not be chilled by the coldness of the substance they light upon.

So soon as the weather becomes mild in the spring, the straw bottom should be taken out and cleaned, and put under the hive again, to remain there till the danger of the frost is past. The hives should be then carefully again cleaned, and the quantity of honey examined into; for if the weather comes in so warm as to tempt the bees out, a greater quantity of food becomes necessary to support them in this labour, at a time in which plants yield little of that juice which constitutes honey; especially if the weather is dry and windy. In April, their young brood occasions an additional consumption of honey; and therefore a supply becomes peculiarly necessary; and should be given to them as above directed. Owing to this neglect, many
hives

hives are lost so late as in the month of May. If one of my under hives, which had some honey in it, was taken in the autumn to be kept in reserve, it becomes a very timely supply at this season, and the quantity of comb made to their hands, will forward the bees much in their summer's labour.

Every hive should have a thick covering of straw, properly secured at top, put over it, to throw off the rain as well as keep the bees warm. Some people advise putting a kind of grating before the doors of the hives during the winter, which at the same time that it prevents the bees going out to their destruction, admits sufficient air. I am of opinion that this is wrong, because that as it is necessary they should eat a little, so they must go out at times to discharge their excrements. They have the sagacity to judge of the proper degree of cold, and when they feel it too great upon coming to the door, they drop their excrements on the stool, and return to their companions, unless they are allured out by a very bright sun. On this account it is proper that during the winter, the mouth of the hive should not face the sun at noon, but rather the west. The mouths of the hives should be lessened so much during the winter, by means of a slider fitted to it, that there may be room left only for air, and to afford a passage to two or three bees.

Even in spring many bees lose their lives, being tempted out by a bright sun in search of food. The mouth of the hive should therefore be continued facing the west, till all danger from the cold is past: for if the mouth was placed to the south, a clear morning may carry them out, being tempted by the glare of light which shines in; but such a morning often brings a cloudy afternoon, which then prevents their going out. When the season for working comes on they must not be restrained from going out by any bar in their way; for they become then so impatient of confinement, that they will even die in search of an out-let, rather than bear imprisonment.

CHAP. XI.

Directions for making Mead.

ALL the writers who have hitherto treated of this subject, have given into a capital error with regard to the strength of this liquor, by directing too great a proportion of honey to be dissolved in the water. The usual practice of making it so strong as to bear an egg, is very wrong. The liquor is thereby rendered a mere stum, and this bad quality is still increased by the long boiling generally practised. It is scarcely possible to procure honey so pure but that some bee-bread, wax, or other substance is mixed with it; and this cannot be perfectly separated from it, so far as I know, but by boiling. On this account therefore, the boiling of mead seems indisputably necessary. In order the more effectually to separate these impurities from the liquor intended to be boiled, it is advisable to mix some whites of eggs with it before it is put on the fire: very particular care must absolutely be taken to skim off the thick scum that rises upon it, the moment before it begins to boil, and this must be attentively continued so long as it does boil. The only intention of boiling being here to separate the impurities, and to make a perfect union of the water and the honey, both which purposes are very soon obtained, it evidently appears that the boiling need be of but very short duration. This circumstance should be particularly attended to in making of mead; because, the longer the boiling has been continued, the less will the liquor be disposed to ferment kindly. It is perhaps owing to our too long boiling only, that mead, highly esteemed by most of the northern nations, has long lain under discredit in this country; a discredit from which it might probably be retrieved, if due care were taken to prepare it rightly. The common method of boiling it too much has always prevented its fermenting sufficiently to remove its luscious sweetness; whereas, were it to undergo a due fermentation, that sweetness would go off, and the liquor would acquire a fine racy flavour.

Some notable housewives have added hops to their mead. This helps to take off its sweetness, and as the bitterness of the hop goes off, gives it a pleasant flavour. A ferment is here, as in all vinous liquors that are boiled, generally wanted, to bring on a perfect fermentation: but as the least taint in the ferment will communicate itself to the whole liquor, due care should be taken that it be very sweet and good. Mead, judiciously managed on these principles, will keep for years, and be improved by age. It is racked, fined, &c. in the same manner as other whitewines.

B O O K III.

Of Wasps and Hornets, and of the means of destroying them.

Natural History of Wasps.

WE naturally interest ourselves in the actions of animals that live in society. Without being observers of nature, we love to hear of the good understanding amongst *beavers*, who work by concert in building houses of earth and wood, several stories high, in order to defend themselves from inundations. The republics of *ants* and *bees* have gained esteem and admiration through all ages. Societies are perhaps the first and most beautiful contrivance of human reason: we are surprized to find that animals, which we despised, imitate us in this essential point; and after having vainly imagined ourselves the only creatures indued with skill and foresight, we are almost inclined to grant in some insects a greater sagacity than in ourselves.

The *bees* are a pacific people that labour for our good, and in return we interest ourselves for them; other insects make war upon them, and consequently excite our enmity and abhorrence: they have no enemies more dreaded than the wasps, who are not content with plundering them, but likewise devour them. The wasps, compared with the mild and well-policed republic of bees, appear to us a savage nation, a kind of hottentots; but we judge thus ill of them only for want of knowing them. We may apply to wasps, what hath been often observed with respect to a *distant* people, who have been thought *barbarians*, and are afterwards found to exceed *us* in many things. The republics of wasps are in nothing inferior to those of bees; although more warlike, they are not less industrious nor less laborious. In short, they are with respect to bees, what the ancient Spartans were with respect to the Athenians.

I shall not enter into a detail of the several species of wasps, that naturalists make mention of, but shall confine myself to the description of their manners, to the discovery of their industry, and to relating the methods by which they people and govern their states: I shall therefore say nothing of those species that live recluse like hermits. The objects of my enquiry shall be only such as live in society, such as form with toil and industry a sort of cakes, composed of hexagonal cells like those of bees, but made of materials very different from wax.

These heaps of cells are principally destined to lodge eggs and embryos till they are able to take flight. We give the name of a wasp-nest to *these* cakes, including under that term all that the wasps build round about the cakes. We shall content ourselves with *distinguishing* these insects into three classes; and *that*, with respect to the places they chuse for building their nests. Those of the first class attach themselves to plants and branches of trees. There are several species of this kind, which are all of the smallest size, and compose likewise no very numerous states. The wasps of the second class commonly place their nest under a covert; they build it either in the hollows of trees, or in granaries that are little frequented. These are the largest of all, we call them hornets. Lastly, those of the third class build only under ground; they are not so big as the hornets, but are sometimes bigger than those of the first class; they are the most common of all in the kingdom, and assembled in the greatest number; several thousands of *these* live together in society.

The wasps of all these classes resemble each other in their contrivances; they work all their nests pretty much with the same art; their occupations are nearly the same within their nests; so that I shall give only the history of *those* of the third class *in detail*, and shall barely mention the others as occasion offers itself of taking notice of any thing particular. In order to make them known, it is sufficient to observe that they are *those* of the third class, against whom

whom we have so much difficulty to preserve our fruits, particularly the muscadine.

These wasps that build under ground, are not greedy of fruits, but must be ranked amongst the most carnivorous insects; they make cruel war upon all other flies; what they catch by chasing is not sufficient for them; you find them in great numbers in butchers shops in the country. After having satiated themselves *there* with meat, they cut off sometimes pieces bigger than the half of their body, and carry them to the nest. On each side of the mouth they have a talon, or, if you will, a long moveable tooth; the extremities of these two teeth or talons are dented like a saw; it is with these teeth that they cut off pieces of meat, which they gnaw all round and underneath till the slice holds no longer by any thing: they are employed on it with so much eagerness, that it would be easy to kill them even with the hand, without any risk of being stung, and to destroy in that manner a great number of them every day. Notwithstanding their robberies, the butchers in the country live in tolerable peace with them: I have a butcher at Charenton that does more, he even makes their robbery turn to his account. They are particularly fond of a calf's liver, he therefore allots them one every day towards the end of summer, or sometimes only the milt of an ox; they attach themselves to this food by choice, and will touch no other meat: whether it is that *these* are more to their taste, or whether, being more tender and less fibrous, they are more easily cut. It is not however merely to hinder them from touching other meats, that he abandons to them *these*; another reason, of œconomy, induces him to it. Flies, and particularly the large black flies, deposit their young upon meats, which causes their corruption much faster. Now the wasps defend the meat from these large flies; they dare not remain in the shop, there is no safety for them, they are pursued by the wasps; and it costs the butcher no more for the defence of his shop, than the milt of an ox, or at the most the liver of a calf each day.

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When they are fatiated, and loaded with plunder, they return to their nest. The first gate that conducts into it, is an hole about an inch in diameter, the opening into which is on the surface of the ground; the edges of the hole are turned up like the burrows of a rabbit warren, but the earth round about it is covered with grass. This hole is a kind of gallery that the wasps have undermined; it seldom goes in a straight line, but in windings and turnings; the passage is not always of the same length, because the nest is sometimes nearer, sometimes further from the surface of the earth. I have never found any nest, whose highest part was not at least half a foot, but I have found several, that have been more than a foot, or a foot and a half distant from the surface.

This hole is the passage that leads to a little subterraneous town, which is not built indeed in our taste, but yet hath its symmetry; the streets and apartments are regularly disposed; it is even surrounded by *walls* on all sides: I do not give this name to the sides of the hollow where the nest is situated, but the walls I speak of are in reality only paper walls, yet strong enough for the uses to which they are destined; they are sometimes more than an inch and half thick.

These walls, or, to speak less metaphorically, this external covering of the wasp-nest hath different figures and sizes, according to the figure and size that the wasps have given to the works, which it includes. Commonly the external figure of the nest resembles a bowl or a spheroid, whose least diameter is sometimes horizontal, and sometimes vertical. I have found some nests that had the figure of a cone flatted, and somewhat narrower towards the base. This cone was between fifteen and sixteen inches high, and was about a foot in diameter near its basis: the diameter of those which resemble a bowl, is commonly between thirteen and fourteen inches.

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I have said that the external covering is a sort of paper; I know no substance which it resembles more, though it differs a little from our paper; its predominant colour is an ash-grey, with divers shadowings; sometimes it inclines very much to a white, and sometimes to a brown or yellowish: these colours are irregularly varied by bands or streaks about a line broad, which gives a very remarkable colour to the whole outside of the nest, and makes a sort of *marbling*.

But what renders it still more singular, is the arrangement of the different species, of which this covering is composed; we have compared it to bowls and to cones, but we did not design to convey an idea that it had the *polish* of bowls: on the contrary, its surface is extremely rough; at the first view you would take it for a rock made of icicles. We shall describe it more particularly in speaking of the manner of its structure.

Each nest hath two round holes, by the one of which the wasps constantly enter, and come forth by the other; each hole can let but one wasp pass at a time; although the holes are narrow, by means of this *regulation* the motion of the wasps is never retarded.

We are yet only arrived at the gates; we will now enter into an examination of the inside of the nest. It is occupied by several flat cakes, parallel to each other, and all placed nearly horizontal. They resemble the cakes or honey-combs of bees in *this*, that they are every one an heap of hexagonal cells, very regularly built; but they differ from the honey-comb in many circumstances; *they* are made of the same materials as the external covering of the nest, that is to say, of a sort of paper; *whereas* the cakes of bees are composed of *two* ranges of cells, of which some have their openings on one of the faces of the cake, and others open on the other face; *those* of the wasps have only a *single* range of cells, and *all* have their openings at the same place, namely at the bottom. *These* cells contain neither wax nor honey, they are destined only for lodging eggs, for the

the worms that are hatched from them, and for the young wasps that have not yet taken flight; *whereas* the worms that are the offspring of bees lie almost horizontal; *those* of wasps stand almost direct, with their head downwards, because they have it always turned towards the opening of the cell. The thickness of the cakes is pretty near equal to the depth of the cells, and proportionate to the length of the flies.

All wasp-nests do not contain an equal number of cakes; I have found in some to the number of fifteen, and in others no more than eleven; the diameter of the cakes varies in the same proportion as *that* of the covering. The first, the uppermost of the cakes hath often no more than *two inches*, whilst those of the middle have *a foot*, in diameter; they are likewise smaller than those of the middle.

All these cakes are disposed like so many floors, or stories, which furnish lodgment to a prodigious number of inhabitants; we may make a gross calculation of them. Instead of fifteen cakes, *unequal* in diameter, let us suppose that they are every one eight *inches* in diameter; or, to make a more commodious calculation, let us suppose these cakes to be squares whose sides are eight inches. I do not believe that I have been too favourable to our calculation. I have found that seven cells ranged in a row took up no more than the length of an inch and half. By consequence in an inch and half square there are forty-nine cells; now if an inch and half square give forty-nine cells, forty-nine inches square, which are the surface of one of our cakes, will give about 1067 cells; therefore our fifteen cakes will have about 16005 cells. Indeed there is something to be bated in this sum on account of the inequality of the cells, which we shall mention hereafter. But though we should allow only room for ten thousand flies, it would be sufficient to give an idea of the numerous people of these little republics; particularly when it shall be seen that there is not perhaps a cell that one

with another doth not serve to produce three young wasps. Thus a wasp-nest breeds in a year more than 30,000 wasps.

The different *floors* or cakes, leave between them a free passage for the wasps; there is always between one and another half an inch distance, yet *this* doth not make very lofty stories, but their height is proportionate to *that* of the inhabitants. They are all suspended in such manner that the *first* bears almost the whole weight of the others; it is fastened to the roof of the wasp-nest, the *second* is fastened to the first, the *third* to the second, and so on successively to the last. They are *thus* connected together by a sort of *little columns*, consisting of the same materials as the cakes and the rest of the nest; the architecture of these columns is indeed very *plain*, they are barely round, their bases and chapiters however have a larger diameter than the rest; by the *one* they are connected to the inferior cake, by the *other* to the superior. They have towards the middle scarce more than a line in diameter, but at the base and chapter more than two lines. There is therefore between every two cakes a sort of rustic colonnade, for the great cakes are suspended by more than fifty such columns. The cakes are fastened likewise in some places to the borders of the wasp-nest, which consequently lightens the weight of each superior cake.

Hitherto we have only given a general idea of the edifice; we shall now shew how the wasps build it, of what use it is to them, on what they are employed in the inside, in a word, we are to pry into the whole government of this little people. But these are state-mysteries that pass under ground; they are not to be penetrated into, if the wasps are left in their natural habitations. I have attempted to draw them from *thence*: I have tried to put them more within reach of observation, and have succeeded so far as to lodge them in glass hives, such as the curious make use of for bees. *There* I have at leisure seen all their little contrivances, and have shewn them to such persons as have visited me at my country-house.

It doth not seem easy to transplant the lodging of such untractable insects; but the love they bear their young hath gained me success. If there be any case wherein natural history exposes a man to hazards, *this* surely is one. You must brave the stings of several thousands of wasps, that on all sides attack you on attempting to disturb them. The wounds they inflict are not indeed mortal, but are extremely painful.

With an undaunted spirit of philosophical heroism, M. de Reaumur encountered these difficulties, and dislodged a nest together with all the earth that naturally environs it. I ordered a servant, says he, whom I had disciplined and armed cap-à-pe for these wars, to cut up a large clod of earth, in the middle of which was incamped a nest. After having conveyed the whole clod into my garden, I pierced it in different places in order to procure peep-holes for seeing what passed about the nest; but I found afterwards that it was of no use to take away their nest *upon a clod*; the love these insects have for their nests or rather for their young is inconceivable; whatever disorder and confusion is made in their nests, although it be broken and almost torn in pieces, they never abandon it, but follow it every where; it is full of young wasps that require their care and nursing; insomuch that in order to have an hive, wherein a wasp-nest hath been put, well peopled, you need only give these flies sufficient time for returning to their nest, and for that purpose wait only till the evening before you transplant it, otherwise you lose those that were out in the country. Those that happen to be abroad when a nest is transplanted, at their return to their hole finding no more their companions nor nest, know not which way to go, but continue several days about the hole before they determine to quit it.

After they have been put in the hive they begin with working to repair the disorders of their nests. They remove with wonderful activity all the earth and filth that may have fallen into the hive; afterwards

afterwards they take care to fasten their nests firmly to the sides of the hive where it has been placed; they work at repairing the breaches; are employed in making it stronger, and increase considerably the thickness of the external covering.

This cover of the wasp-nest is a work particular to these flies; bees do not cover *their* cakes or combs. We have already mentioned that this cover is more than an inch and half thick: it is not of a massy thickness, but composed of several vaulted strata that leave vacuities between them. In proportion as the wasps thicken this cover, they build on the strata already formed another stratum composed of the like vaulted pieces.

The cover is a kind of box, that seems made for including the cakes and sheltering them from the rain which penetrates sometimes through the ground. It is proper for this purpose, although it consists only of a sort of paper, by means of the architecture we have been mentioning: had it been entirely massive, it would have been more easily soaked through. By being *arched* the water that hath penetrated through *one* arch can only wet *that* underneath by droppings, whereas if the whole was massy the water would pervade by contact alone: besides, this sort of architecture saves a great number of materials. Nothing is more amusing than to see them work at enlarging or thickening this cover. There is no work that they carry on with greater dispatch; a great number of wasps are employed on it, but the whole is performed without any confusion. They fetch the materials necessary from the country round about; the wasp, that collects them, *herself* employs them on the work; the builder or mason wasp (for others have other employs which we shall mention presently) returns loaded with a *little ball*, which she holds between those two talons, that we have said she makes use of for cutting off pieces of meat. This ball is the *matter* prepared for the work; the wasp being arrived at the nest carries it to the place she would enlarge; the ball is soft as paste; she fastens herself to the

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the part on which she hath applied and pressed her little ball. Immediately afterwards you see the wasp retiring backward, and as she moves she leaves a *portion* of her ball, but not detached from the rest, which she holds between her two fore legs. Imagine to yourself a paste that is ropy, or a piece of soft clay, that you would add round the brim of an earthen vessel, and you would form an idea of the manner in which the wasp labours. Her two talons act as the thumb and finger of the potter would do, in pasting new earth to the brims of the vessel, in drawing it out, and flattening it down.

This new *rim* (*perhaps the Latin word fascia will more fully convey the meaning of the French term bande*) that hath been applied is yet too gross and unpolished; her next work is to make it thin and smooth; she goes without the least loss of time, and resumes her task *where* she first begun. This second labour is pretty much the same *in the manner of working* as the former. Her talons by patting the soft matter extend it; she goes over the work in this manner four or five times till she hath reduced the additional part to the thinness of the rest, or to *that* of a leaf of paper. It must be observed that it is with extreme quickness that the wasp labours, and always retiring backward; by this means she is in a condition of judging continually whether her work is good: the motion of her talons is much quicker than *that* of her legs. Each *rim* or *leaf* is about a line in breadth, and are *all* of different colours; which is owing to the different coloured materials, of which they have been composed. This I was convinced of by the following expedient: With a stick smeared at the end with glue I took out of the hive whatever wasp I had a mind for; those that I took, loaded with *a ball*, never quitted it notwithstanding the violence that I did them; they would still preserve the fruit of their labour. Amongst these *balls* some were white, others yellowish, and others blackish.

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We are now to examine the composition of these *balls*. There is nothing in the whole history of these insects that was longer concealed from me. In vain had I observed wasps on all occasions when I could suspect that they were going to collect materials, I could never succeed in surprizing them at the time they were loading themselves. Bees that gather their wax and honey on flowers, even wasps themselves, that settle on plants and trees in order to suck the juice of the leaves or what exsudes from the stems, had thrown me wide of the mark; I thought to find them on such plants tearing up fibres for forming their paper. After a fruitless search and *when* I no longer pursued my enquiries on this insect, a mother wasp, of the subterraneous kind, came to inform me of what I had sought so often in vain. She placed herself near me on the frame of my window that was open. I saw her continue at rest in a place, from *whence* I could not imagine she could draw any thing very succulent. Whilst the rest of her body was *still*, I remarked divers motions of her head. It immediately came into my thoughts that the wasp detached from the *frame* materials for building, and the notion proved true. I observed her with attention; she seemed to nibble the wood, her two talons acted with extreme agility in cutting off fine pieces. She did not swallow what she detached, but added it to a little heap of the same materials which she had already collected between her legs. In a little time she changed her place, but still continued nibbling. I afterwards caught the wasp whilst she was busy on this work; I found her loaded with pretty near such a quantity of materials as they are wont to carry to their nest; she had not however *yet* formed it into a ball. The matter was not moistened so much as it is when the insect cements it to her work.

I examined this heap of filaments, which in all respects, except *that* of not being yet well moistened, resembled the balls which I had taken from wasps employed on building. These filaments appeared however very different from what one would expect the
insect

insect to detach from wood by nibbling. One would imagine that they should resemble saw-dust, that each bit should be pretty near as wide as long; each filament on the contrary was extremely small, although it had *at least* a line in length; there were even *some* much longer. Big and short pieces of wood, like *those* of saw-dust, would not suit our subterraneous wasps; *they* could not well be interwove for making a fine paper, it is necessary to have a sort of threads like to *those* of the paper which we make use of: and in getting *such* we must take notice of the great sagacity of the wasp. She doth not merely hash the wood, which would only give her little short pieces like *those* of saw-dust; but before she cuts it she makes, as I may say, a sort of scraped lint; she presses the fibres between her talons, raises them up, and by that means separates them one from another; having done *this* she afterwards cuts them.

I learnt this cunning of the wasp, not only from observation, but was assured of it likewise by detaching myself the fibres of wood with a penknife. I rubbed *at first* the wood lightly with the blade of the penknife, in order to separate the fibres one from another, and I rubbed it *afterwards* more strongly in order to detach them. I collected in this manner filaments, which I compared with *those* that the wasp had collected, and could observe no difference between them.

Ever since I observed the wasp detaching wood from my window, I had been attentive to observe the actions of *those* that settled upon dry wood, and have remarked that wasps of all sorts go *thither* to cut filaments necessary for making their paper. I have seen them particularly attach themselves to the supporters of espaliers, to the frames and shutters of windows. But it is to be observed that they attach themselves only to old and dry wood, which hath been a long time exposed to the injuries of the air. It would not be easy to *draw* the fibres of *flax* fresh pulled; in order to draw them it is left

to *steep* for a certain time ; that is to say, it is kept soaking in water for several weeks, and afterwards is dried. The first surface of the wood, that hath been exposed several years to the injuries of the air, has been so often watered by rain, that it is in the condition of flax that hath been steeped. The cakes and columns, that support them, are made of the same materials. The wasps likewise work the *cells*, that compose the cakes, in the same manner as the *strata* that form the cover ; but the texture of the cells is more *loose* and resembling net-work ; on the contrary, the texture of the column is more *close* and compact. These columns are intirely massive, it is necessary that they should be much stronger than the rest. The wasps *do* them *over* sometimes with a sort of varnish, they rub them with their mouth, the places rubbed appear shining and always continue *so*. This varnish is perhaps the glue that binds together the threads of which their paper is composed.

N. B. *I cannot help observing that the artifice of the wasp in making paper, gives great light into the manner in which the ancients made their paper of the Egyptian papyrus. They might indeed have made it in much greater perfection, had they more carefully observed and been instructed by the wasp ; for Pliny in describing the method of making it says, præparantur ex eo (scilicet papyro) chartæ diviso acu in prætenues sed quàm latissimas philuras. Mr. de Reaumur hath remarked the great sagacity of the wasp in avoiding that error, and the reason on which her practice is founded.*

The cells of the cakes are hexagonal : but I know not whether this figure enters into the design of their architecture, or is owing to the young wasps pressing the cells and making them take this figure. This is certain, that the outward cells have the half of their circumference *round*.

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A great part of the wasps which we ranked in the first class, of those that build their nests on plants or on branches of trees, give their nest no covering at all. Their cakes are *bare*, and their position is vertical. The species of this class are often content with making a *single* cake; *some* give it no more than two or three inches diameter, *others* give it five or six inches. Sometimes however they make two or three cakes parallel one to another.

There are in the kingdom wasps of *this* class that give their nests very singular covers. Mr. Varignon brought one of them to the academy some years ago, Plate 5. Fig. 2. whose covering resembled very much a rose not yet *blown*; it was in *like manner* composed of several leaves applied one upon another.

But all the wasps of this kingdom, that I know of, form nothing so singular as a species of wasp at Canada, whose nest is in the cabinet of the king's garden, and hath been communicated to me by Mr. Vaillant. At the first view, and even after having examined *some time* the surface, one would take it for a work of human composition. Its cover resembles so much our paste-boards, that it is not enough to say it resembles them; you can find no difference between the one and the other: it hath the polish, the colour (which at present is *that* of old paste-board but was formerly white) and likewise the texture. It is a fine paste-board and as thick as *that* of common portefeuilles. This cover approaches in figure to a cone, but the summit of the cone is not very pointed; near the summit it hath a long hole through which passes a branch of a tree, that had been chosen by the insects for suspending their nest, one could not draw out this branch without tearing the paste-board.

The wasps of the second class, the biggest of all and called hornets, make in granaries and in hollows of trees their nests pretty much like *those* of our subterraneous wasps, only their paper is of a

coarser sort, the predominant colour of it is yellowish, whereas *that* of the subterraneous wasps is an ash-grey.

The wasps of all ~~these~~ classes begin with building the first or superior cake. Before they begin on a cake, of whatever range it be, they form one of the columns that is to suspend it; upon the inferior *end* of this column they build the first cell of the cake; they surround it afterwards with other cells; they begin to form new columns in proportion as the increase of the number of cells requires it, and they extend the outward cover in proportion as the number of cakes enlarges.

The construction of the wasp-nest is not the only employment of the wasps, it is but a small part of them which are concerned in the building; the others have other employs. In order to shew their different occupations it is necessary to give a more perfect knowledge of the inhabitants of our little commonwealth, than we have hitherto given. What we are going to relate of them will serve to confirm the notions of Mr. Maraldi with regard to bees.

In the insect kind *those* which have stings are a people quite *distinct*, that have scarce any similitude with any others. The same wasp-nest is inhabited by three sorts of wasps different in size, and which have some differences likewise in shape; or they may be distinguished into three sexes, *males*, *females*, and such as I shall call *mules*, although they have nothing in common with real mules but their inability of perpetuating their species: of which I am fully convinced by my own observations. The males are amongst wasps what the *drones* are amongst bees; the females in the wasp *state* hold the place of the king or queen amongst the bees. But instead of there being only three or four females, as in the bee-hive, I have seen in wasp-nests more than between two and three hundred at a time. Lastly, those of our wasps, which I call mules, are amongst *them*, what the *generality* of bees are in the bee-hive.

These

These mules are the most numerous part of this republic; they bear all the burdens of it; it is they that build, that provide food for the males, females, and even the young wasps for a great part of the year. Excepting those which are employed in collecting materials for the construction of the edifice, and in performing the office of masons, the rest go in pursuit of plunder; some catch insects, the paunch, and sometimes the whole insect is brought home to the nest; others pillage butcher's shops; others ravage fruits and carry home the juices they have collected. When they are arrived at the nest they communicate their prey to the females, to the males, and even to other mules who on account of their having been employed within doors could not go and provide *themselves* food. Several wasps assemble round the mule that is just arrived, and each takes his *portion* of what is brought. This is transacted with the utmost harmony; the following observation is a proof of it. Those, which instead of going upon the chace have light upon fruits, bring back nothing *solid* to the nest, for they never carry fruits or portions of fruits. Yet these mules, which in appearance bring back nothing, contribute to the regaling their companions. I have seen them several times, after they have entered the hive, repose themselves quietly on the upper part of the nest; after *which* they discharged from their mouth a drop of clear liquor, that was greedily sucked up, sometimes by two wasps at the same instant; after that drop, the mule discharged a second and sometimes a third, which were distributed in like manner to other wasps.

The mules, although the most laborious, are the *least* in size; they are the most lively, light and active. The females are the *biggest* and *heaviest*, they move more slow and sedate. The bigness of the males is of a middle size between *that* of the mules and females.

During the months of June, July, August, and the beginning of September, the mother-wasps keep themselves confined to the nest,
they

they seldom go abroad but in the beginning of the spring, and in the month of September ; at the other times they are employed in laying eggs and feeding their young, which is no small occupation ; indeed *by themselves alone* they could never sufficiently attend such a prodigious number of young as we have *before* calculated each wasp-nest contains. They feed them as birds feed their young ones. Every moment they are carrying them a bill full. It is surprising to see the activity with which a mother wasp runs through the cells of a cake one after another ; she puts her head pretty far into those cells where the young are very little, what passes *there* is concealed from the eye of the observer ; but it is easy to *conjecture* by what one sees done in those cells where the young are bigger and ready to undergo their metamorphosis. Those we have last mentioned being more advanced are less quiet, they put forth their head quite out of the cell, and by little gapings seem to crave for food. The wasps of the larger sort, the hornets, before they give food to their young, press a little their head between the two talons we have so often mentioned. I am inclined to think that the attention of the wasps goes so far as to adapt the food to the strength of the young, for I have seen *some* give but a drop of *liquor* to such as were pretty big, and have seen *solid* food given to such as were bigger. The mothers not being sufficient to distribute nourishment to so many young, the males are often employed in that service. I have made an observation on the wasps of the first class, which seems to prove that *they* feed their young in the manner of birds which *disgorge*, that is to say, swallow the grain and let it soften a little and be concocted in their crop, before they offer it to their young ; for I have seen a mother-wasp of this sort, which brought home the paunch of an insect, after having swallowed it intirely, go through her cells and leave the young some pieces *so large* that they were scarce able to swallow them,

I have taken away fragments of cakes, full of little wasps, which for want of the mother's bill sucked what I gave them. It would
not

not perhaps have been impossible to have *reared* them, if one would have taken the trouble.

N. B. *This experiment hath been since tried with success by a youth, who took pleasure in feeding wasps with honey, as the generality of boys delight in breeding birds.*

Vid. Mr. De Reaumur's history of insects, vol. 6. pag. 190.

The young wasps are not in the cells under the *form* of wasps; when they have taken *that* they remain there but a little time. They are produced from a white, transparent egg, of an oblong figure, very like the kernel of a pine-apple, excepting that it is bigger at one *end* than at the other. Eight days after the egg hath been laid, you find in the cell a worm, which is considerably bigger than the egg; perhaps this worm is the egg itself more developed; the head is *then* discernible, you may distinguish the two talons. The worms continue to grow till they become big enough to fill intirely their cells. When they are arrived at that size, they are ready to undergo their metamorphosis; they have no longer need of taking food, they enjoin themselves a fast, and forbid all commerce with other wasps. They stop up the mouth or entrance of their cell, by making it a little cover; some worms make it almost *flat*, *these* are commonly such as are to be mules, others make it *convex*, and even extend *a little* the sides of the cell by making a border of the same materials as the cover. The cover is of a texture like *that* of the cod of caterpillars or silk-worms. Our *worms* of wasps spin and weave this cover precisely as caterpillars spin their cod; they give themselves the same motions of the head. The thread, of which they form it, is so fine that I could never observe exactly from whence they draw it, although I have sometimes held in my hand the cakes where the worms were at work in inclosing themselves. It appeared, however, to me that the thread came like *that* of caterpillars from a little below the mouth. In about three or four hours the cover of a cell is entirely finished; I have often taken

8

pleasure

pleasure in breaking those that were begun, in order to make them renew their work; but it is necessary that there be remaining still a *provision* of silk in the worm; for if you destroy a cover that hath been made several days, the worm will weave no more. These covers are extremely white, particularly in the nests of hornets.

I have not made very exact observations on the number of days between *the laying* the egg and the worms *inclosing* itself in the cell. I think however that the number of days in the wasps of the first class doth not exceed one and twenty. This I am certain of, that the worms of the wasps of that class do not continue above nine days in their cells, after they have stopped them up. A little after the worm hath inclosed himself, he is transformed into an *aurelia*; he quits his ancient *case* or skin, and is closed with *one* extremely thin, and so transparent that it lets the shape and colour of all the parts of the wasp be seen, although the insect is as it were swaddled in it. At last, about the 8th or 9th day the insect strips off this last covering, and appears under the form of a fly. The first *case* or skin remains so exactly applied to the sides of the cell that it seems to make a part of it. The wasp, that hath just disengaged himself, begins with making use of his talons or teeth, as we have described them before; which he employs in nibbling *all round* the cover that inclosed him; the cover being thus detached, he quits his *abode* with ease. The hornets or large wasps begin with nibbling their cover in *the middle*, and enlarge the hole continually till it can let them pass through.

The wasp that is just at liberty from its cell is not different from those of its species and sex but in this, that it is of a more pale yellow or citron colour; he soon takes the benefit of the food, that hath been brought to the nest by others. In wasp-nests, that are without an external cover, I have seen wasps which the very same day that they were transformed went into the country, and brought back plunder, which they distributed to the young wasps in cells.

The

The cell from whence the young wasp is departed doth not continue *long* vacant; as soon as it hath been quitted an old wasp is employed in cleansing it: in a few days you find *there* a new egg; thus the same cell serves for breeding several wasps.

As the mules are six times smaller than the females, their cells are pretty near in the same proportion. When we said therefore that in a square, whose sides are of an inch and half, there are forty-nine cells, we meant only the cells of mules: the same square contains much fewer cells of female worms; *these* last mentioned are likewise *deeper*, because the females exceed the mules in length as well as bigness.

There are not only cells built solely for breeding *mule worms*, and others for raising up *females* or *males*; but it is to be remarked that the cells of mules are never intermixed with *those* of males or females. A cake is entirely composed of cells for mules, but the cells of females and males are mixed in the same cake; they have need of cells equally deep. The males indeed do not want such wide cells as the females, and therefore *theirs* are much narrower, in the proportion that the difference of size requires.

These piles of cakes, the massy columns that support them, in a word, the whole edifice we have been describing is a work destined for a few months only. Those habitations so peopled in the summer are almost deserts during winter, and entirely abandoned in the spring; not a single wasp remains within them. *Those* that have out-lived the severe season go and begin a new edifice, which together with its future inhabitants owes its origin to a *small* number of wasps, and sometimes even to a *single* wasp.

One of the most singular remarks that the history of these insects supplies, is that the cakes first formed are composed of cells that can contain none but mules. The republic, whose foundations are

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just

just laid, hath need of *labourers*, and *those* are born the *first*. No sooner is a cell finished, and oftentimes it is not above half built, but an egg of a mule worm is deposited in it. As they are first born, so likewise they die the first; whatever pains I have taken to cover well my hives, I never could succeed in having a single one alive at the end of a mild winter.

The females being much stronger and destined to perpetuate the species, support the winter better; but even of *these* there scarce remained a dozen living, some hundreds were perished in the hive.

I am not certain that the male wasps perish *all* in the winter as well as the mules, yet I never could preserve any of *them* alive in my hives; but I think I have seen *some* flying about in the beginning of the spring.

A female wasp becomes the foundress of a republic, of which she is in the strict sense of the expression *the nursing mother*. The establishments they form are very far from being so useful to us as *those* of bees; they are indeed only noisome to us: yet we cannot help acknowledging that they have something in them more great and glorious: if the delight of glory be felt by insects, if solid glory amongst *them* be measured as amongst *us* by surmounting difficulties, by accomplishing enterprises useful to their kind, each mother wasp is an heroine to whom the mother bee, so respected by her subjects, is not to be compared. *In short, we may justly apply to her these lines in Virgil celebrating Rome;*

*Felix prole virum: qualis berecynthia mater,
Læta deum partu, centum complexa nepotes.*

Proud of her sons, she lifts her head on high;
Proud as the mighty mother of the sky;
Who views her sons, that fill the blest abode,
A hundred sons, and ev'ry son a God.

When

When the female *bee* issues from the hive where she was born, to become a sovereign elsewhere, she is attended by a swarm of workmen that are very industrious, very laborious, and ready to execute all the works necessary to the new establishment; whereas the mother *wasp* that hath not a single workman at her disposal, since we have observed that the winter causes all the males to perish, the mother wasp, I say, undertakes *alone* to lay the foundations of her new republic.

The males, which I have already said that I imagine do not *all* perish like the males, although not so idle as the drones or males of bees, yet seem not *by nature* fitted for relieving the female wasp in her most important labour, *that* of building. They are a kind of cotqueans, never employed but in a sort of housewifery, such as keeping the nest clean, sweeping away the dirt, and carrying out dead bodies.

When the mother wasp begins in the spring to build underground a nest, which hereafter will be peopled by so many thousand flies, her future issue, she hath no longer need of consorting with the males; she was impregnated in the months of September or October, and at that time the numbers of males and females are pretty near equal, some hundreds of the one and the other in the same nest.

The courtship and the nuptial rites between the sexes are mysteries that have been revealed to me by means of my glass hives. About the middle of October I saw the females and the males come upon the outside covering of the nest, and keep *there* whilst it was heated by the rays of the sun. I could perceive their coupling performed pretty much in the same manner as *that* of other flies. I sometimes saw a male wasp in love, moving, as I may say, with a discontented air, now going forwards, then suddenly turning back; as soon as he saw a female, he ran, he fled with all the wings of

love——*The rest I must throw a veil over, and refer the curious reader to M. de Reaumur himself in his history of insects, vol. 6. p. 200.*

It is surprising indeed that a single insect should contain so many thousand embryos, but it is not the only instance that nature gives us of it; this fruitfulness is perhaps much inferior to *that* of many sorts of fish.

The females and the mules have a *sting*, the males *alone* are unprovided with it. The sting of the females resembles *that* of the mules, but is much longer and bigger. The violent smart it occasions is produced by a venomous liquor, that is very limpid, introduced into the wound.

Peace doth not always reign in the republics of wasps; there are often combats between mule and mule, and between mule and male. The *last*, although bigger, are more weak or greater cowards; after having held out a little while, they betake themselves to flight: in general the combats seldom end in death, though I have sometimes seen the male killed by the mule. Our female wasps are less murderers than the bees; they do not treat so ill their males as the bees treat their drones.

But now the scene changes; about the beginning of October the wasps cease to think of nourishing their young; from *being* tender mothers and nurses they become unmerciful step-mothers; they tear out of the cells the worms that have not yet inclosed themselves, they carry them out of the nest; mules and males are employed in the cruel work, but I never saw a female engaged in these barbarous expeditions. It is not one single species of worms that the wasps attack, (as Mr. Maraldi hath observed of bees, who at a certain season destroy the worms of drones) mules drag their fellow mules, and males tear to pieces males; the massacre is general. Shall we endeavour to conjecture the reason of such apparent barbarity? Is it
that

that they chuse rather to put to death their young that they imagine they shall not be able to rear, or that they judge will never come to any thing on account of the cold weather they are threatened with? for the cold pinches them all extremely. As soon as the hoar-frosts begin they never stir abroad, till the sun hath warmed the air; as the cold increases, they have not strength to pursue the flies that are their prey; at length the cold destroys them. A few females only survive; *these* pass the winter without eating, for they do not make *stores* like the bees, indeed if they had *any* they would not make use of them: I have often put into their nest sugar, honey, and other foods which they were fond of in the summer, but in the winter they did not touch them.

In every season, on days of continued rains and high winds, they never stir abroad; all keep fast, for they have nothing *provided*.

The subterraneous places inhabited by our wasps, prove that they are naturally great miners, that they make holes and turn up earth with great dexterity. Perhaps they may take advantage of holes that have been made by *moles*, but *still* there must be a great deal of earth to remove in order to make those holes fourteen or fifteen inches diameter, which the size of their nest very often requires. If you stop up the mouth of one of these holes with earth, as I have often done, they do not long continue prisoners; in a few hours they get through this new earth, and remove it away; for the performance of this work they make use of their two talons or teeth.

The sting of the wasp is an hollow tube, open near its point, at which opening issues the venomous liquor. Having been stung by a wasp, I bore it with patience, and let her draw back her sting at leisure; I then caught her and put her on the hand of a servant, whom I had disciplined *so* as not to regard *being stung*: after having provoked the wasp she stung him, but the smart was very little; I immediately

immediately took the wasp and made her sting me a second time; I scarce felt it, the venomous liquor had been almost exhausted; I then provoked the wasp, but in vain, for she would not inflict another wound.

This experiment and some others, that perhaps no one will have an inclination to repeat, have discovered to me that if you let yourself be stung peaceably, the *sting* never stays behind in the wound; it is flexible, doth not pierce an hole direct, but makes the wound in zic-zac: if you oblige the wasp to draw it back suddenly, the friction is great enough to retain the *sting*, which is as it were a little hooked in, so that she tears it away; whereas if you do not hurry the wasp, she gently disengages it by little and little.

Of the Means of destroying the Wasps and Hornets.

I am sorry, that after having given the above very curious, and accurate account of the republic of wasps, again to censure M. de Reaumur for another instance of his want of attention to the advantages the public might reap from his discoveries. This accusation may much too generally be laid to the charge of most of our philosophical inquirers into natural knowledge. How often, for instance, shall we find a botanist, who would readily traverse the banks of the Rhine from the flats of Holland, to the summits of the Alps, in search of a new plant. When discovered, and classed according to art, he rests perfectly satisfied, nor ever dreams whether it can be turned to any public utility. This is left to the plodders, who attend more to the conveniency than to the embellishments of life. A member of the very laudable society instituted at Berne, for the improvement of their (*chere patrie*) dear country, has lately found a wild species of madder growing among them, which is now very usefully employed in dying; yet this plant had no regard paid it by botanists, who remained perfectly satisfied with finding it properly ranked in the catalogue of Alpine plants. We might do equal justice and honour to many hunters after shells and butterflies among ourselves, or other articles of equal importance.

M.

M. de Reaumur informs us, that *all the males*, and he rather thinks, *all the males* of the wasp kind perish in the winter: and of the *females*, *scarce a dozen remained of two or three hundred*, which lived in the same nest in the summer. He tells us also, that a *female wasp becomes the foundress of a republic, of which she is in the strict sense of the expression, the nursing-mother*; yet he could not go one step farther, and point out to his readers the importance of destroying these females at their first appearance in spring, before they have laid the foundation of numerous republics, who are declared enemies to those useful insects, which are the subject of the former part of this work. This consideration will naturally draw upon them the resentment of every owner or friend to bees.

When the females make their first appearance, generally in March or April, flies, their usual food, are scarce, and they are therefore the sharper set on any food laid for them. Honey, and all sweet things, are agreeable to them. If their fragrance is increased by the addition of some fermented liquor, such as wine, cyder, or ale, they become the more tempting. The mixture should be put into phials, which being about half full, are suspended on trees then in bloom, or in other places to which these females resort. They enter in search of food, but as they cannot again ascend to the mouth of the phial, they are drowned in the liquor, and thus many rising colonies are cut off in their very bud.

For this purpose, I would recommend to gentlemen to give a bounty of about sixpence or a shilling for every mother-wasp or mother-hornet brought to them alive, if possible, or dead, provided that they look fresh and moist, and have not the appearance of having been long kept: and this from the beginning of February, when mild weather may bring them forth, to the beginning of May, when they will have made their nests, and then the lives of mothers are not of such consequence. This inconsiderable reward would

would excite the poor as well as boys to keep a sharp look-out for them; by which means greater havock may be made in the breed in one year, than can be done in several years by destroying their nests.

If a few have however escaped these snares laid for them, and have built nests, these should be destroyed as soon as they are discovered, that we may as speedily as possible prevent the prodigious increases of their numbers.

The hornets generally build their nests in the eaves or roofs of houses, especially out-houses, such as barns, &c. and sometimes on the hollow of a tree. As their nests are suspended by a narrow neck, the following easy method of destroying them presents itself. On a rainy day, when all are at home, erect a ladder, which shall reach the nest, and having a bag large enough to contain the nest, ascending the ladder gently, extend the mouth of the bag, so as to take in the whole nest with ease; and having thus raised the mouth of the bag to the neck of the nest, immediately draw the strings, so that nest and hornets be all at once included in it. If a few of the males escape, they will soon perish when they have lost their females, on whom the duration of the state only depends; and we are pretty sure of catching the females, because they do not readily quit the nest. The bag should then be immersed wholly in water, in order to drown the whole family.

The wasps which build their nests in the ground, should be also attacked on a stormy rainy day, a little before night, or very early in the morning, for the same reason. A train of gun-powder, in manner of a squib, rendered a little damp, that it make the greater smoke, should be introduced as far as possible into the hole, by which they enter, and being covered with straw, which is set on fire, the flame will catch the gun-powder, the smoke of which pushing into the nest, will instantly suffocate all the wasps. The nest

nest should then be dug up, and be thrown either into water, or into a fire, that they may be destroyed beyond a possibility of recovery.

As these operations are attended with some danger, especially in case of the least mismanagement in taking the hornets nests, and as people in general have a dread of these insects, whose stings occasion great pain, it would be adviseable to have the head and hands covered in the manner already directed, as a safeguard against bees, till such time as practice has rendered the operation familiar to the person who performs it.

EXPLA-

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EXPLANATION of the PLATES.

PLATE I.

Fig. 1. Is the queen bee.

2. Is the drone.

3. Is the working bee.

4. Represents the bees hanging to each other by their feet, which is their method of taking their repose.

5. The proboscis or trunk, which is one of the principal organs of the bees, wherewith they gather the honey and take their nourishment.

6. One of the hind-legs of a working bee, loaded with wax.

7. A comb, in which the working bees are bred.

The cells are the smallest of any.

Two of them have the young bees inclosed.

A royal cell is suspended on one side.

8. A comb in which the drones are bred, being larger than the former; the young drones being included in several of them; with two royal cells, suspended on the side.

9. A similar comb, in which the royal cell is fixed in the middle of the comb; and several common cells are sacrificed to serve as a basis and support to it. In general the royal cells are suspended on the side of a comb, as in Fig. 7, 8. To the side of Fig. 9. two royal cells are begun, when they resemble pretty much the cup in which an acorn lies. The other cells have the young queens included in them.

The Figures in Plate II. are particularly described in Chap. I. Book II.

PLATE III.

Fig. 1. Shews the internal structure of a wasp's nest.

2. Shews a wasp's nest from Canada, in figure nearly resembling a cone, suspended on a branch of a tree.

3. Shews a wasp's nest, whose covering resembles a rose not yet blown.

Fig. 7.

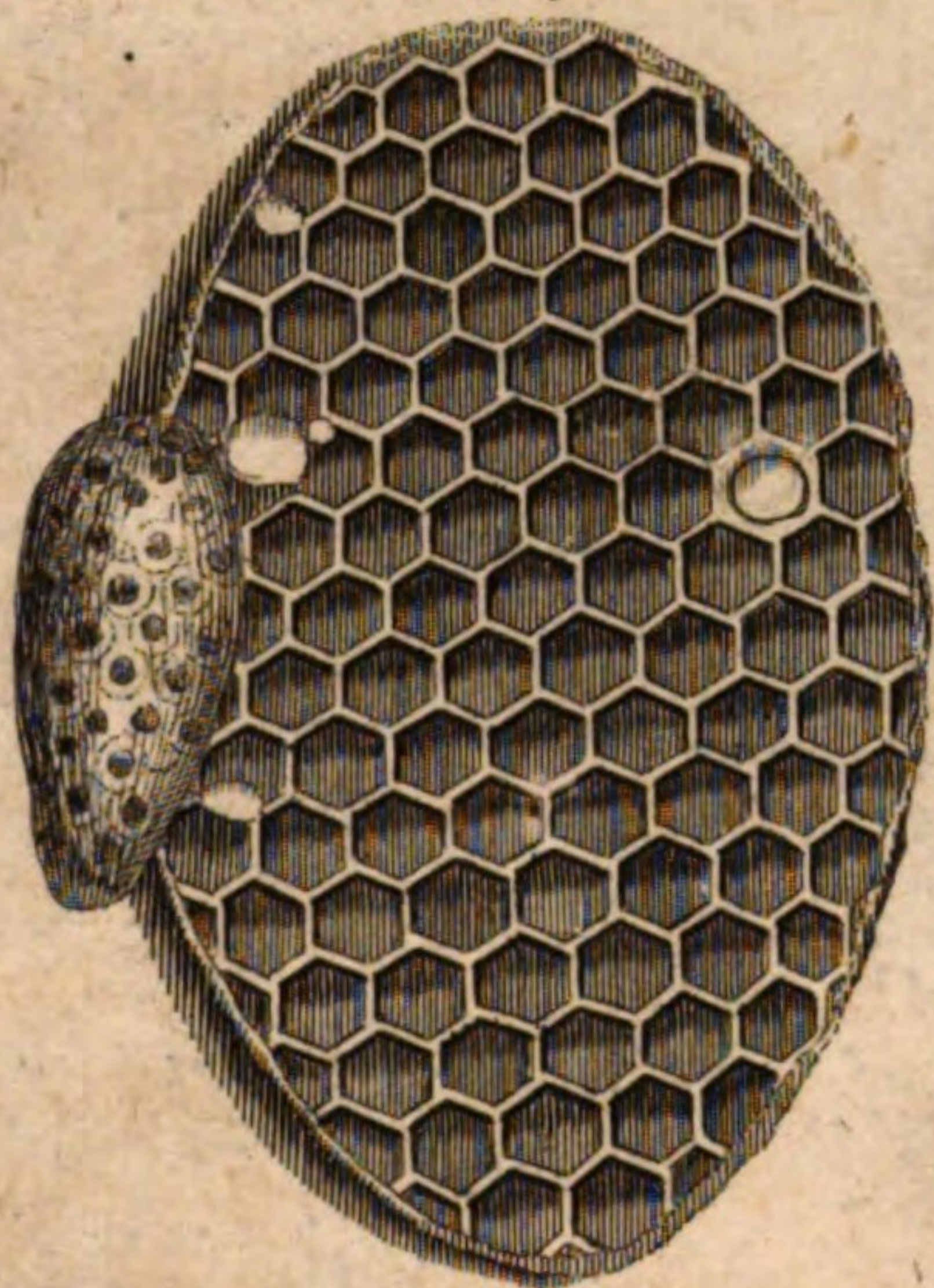


Fig. 8.

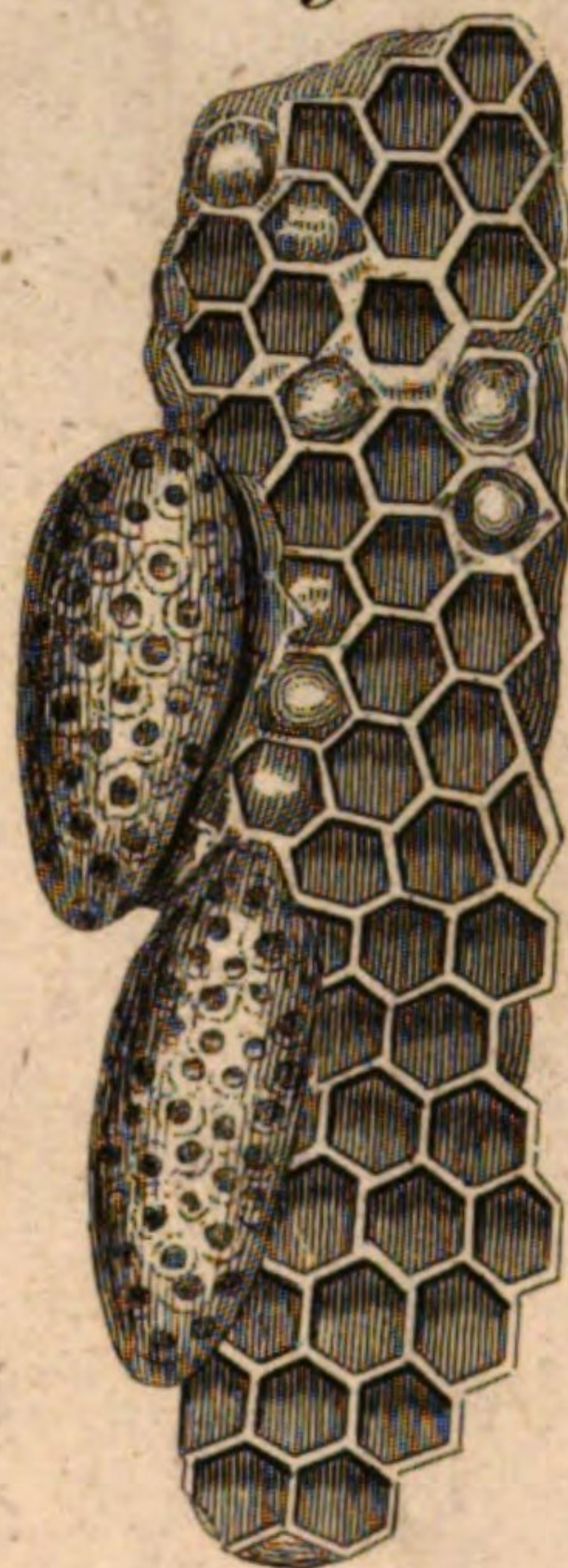
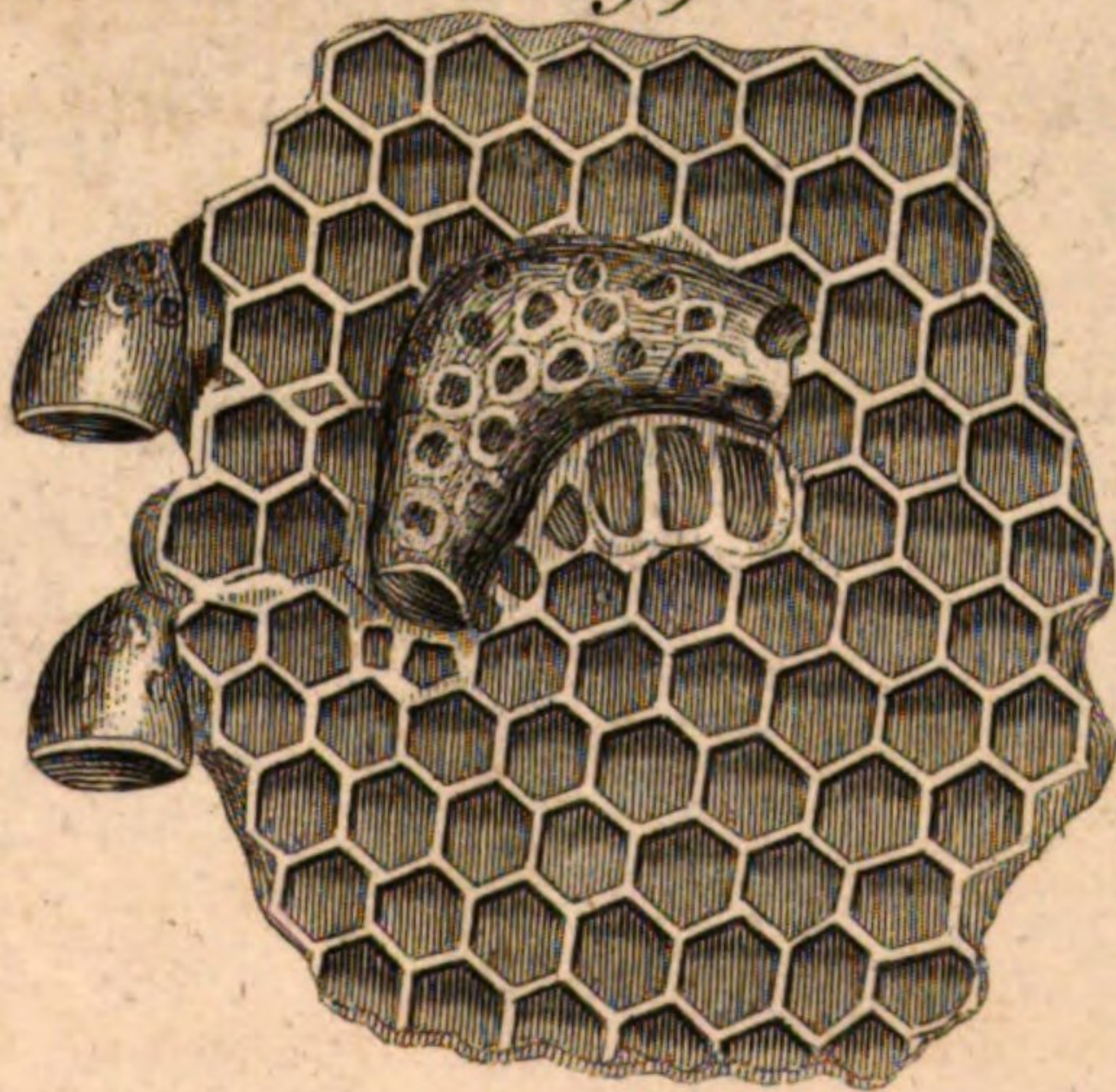


Fig. 9.



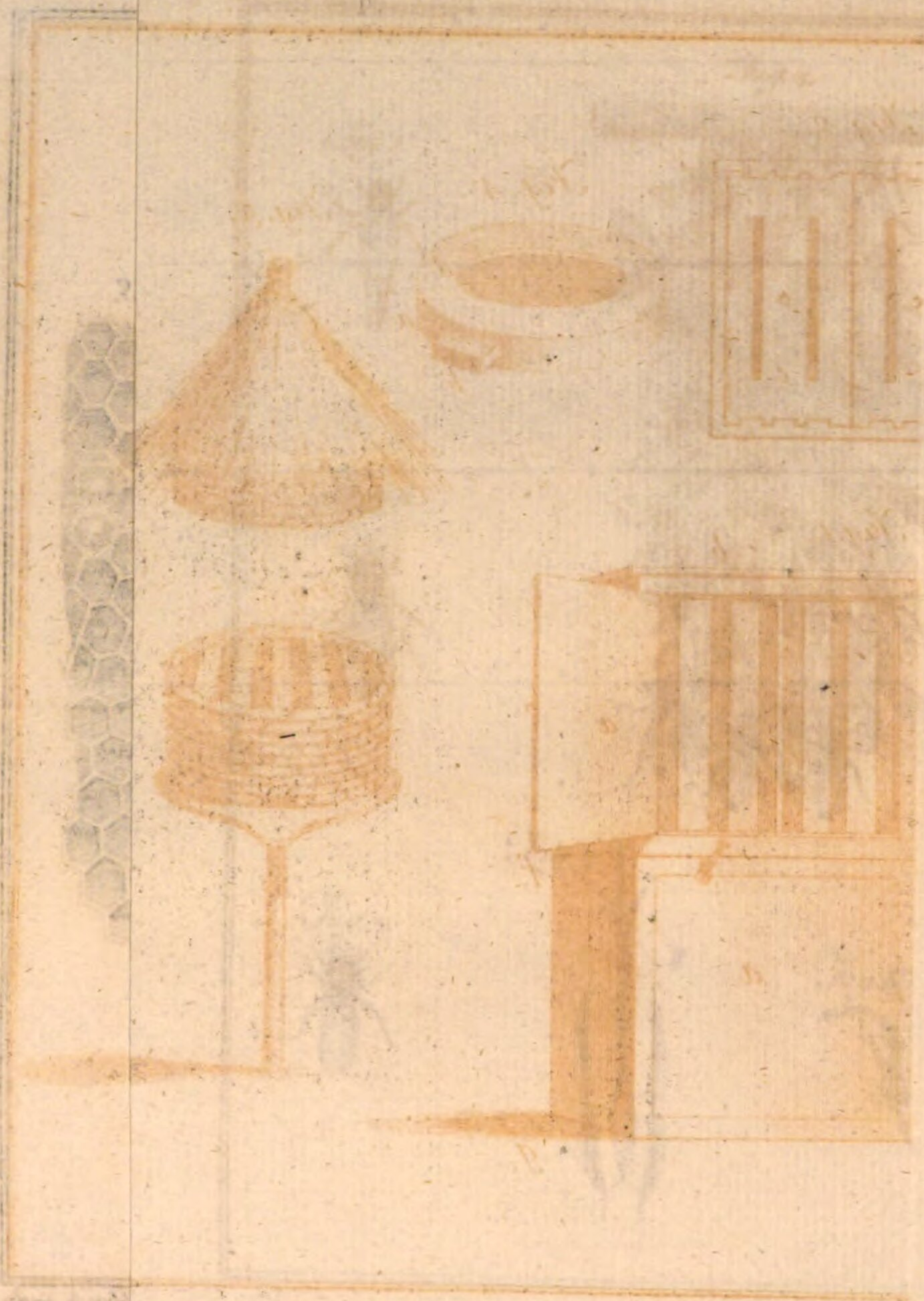


Fig. 2.

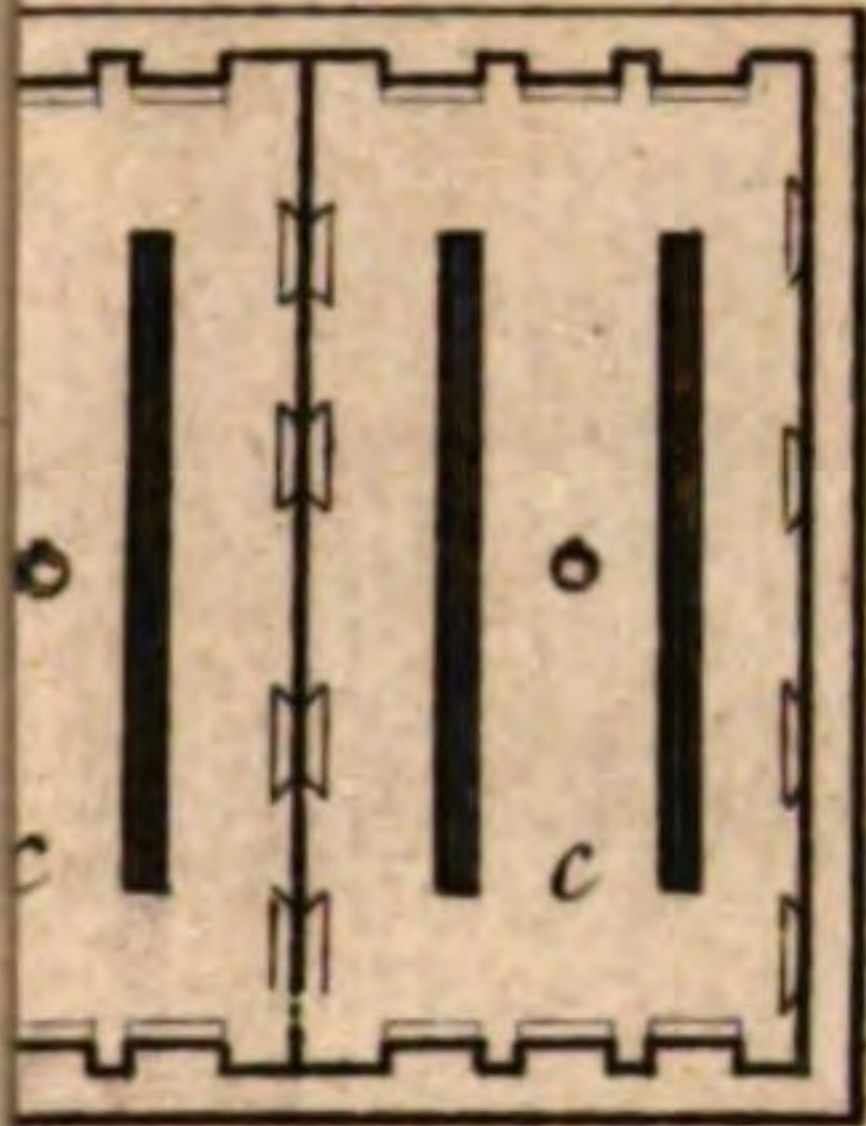


Fig. 4.

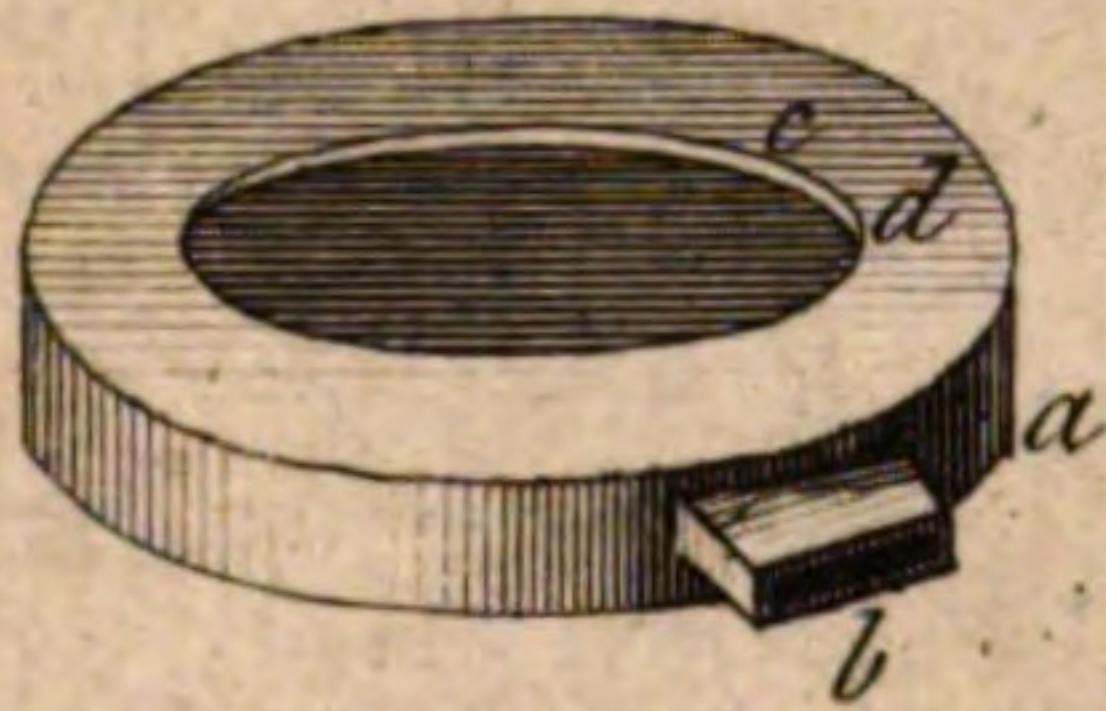


Fig. 5.

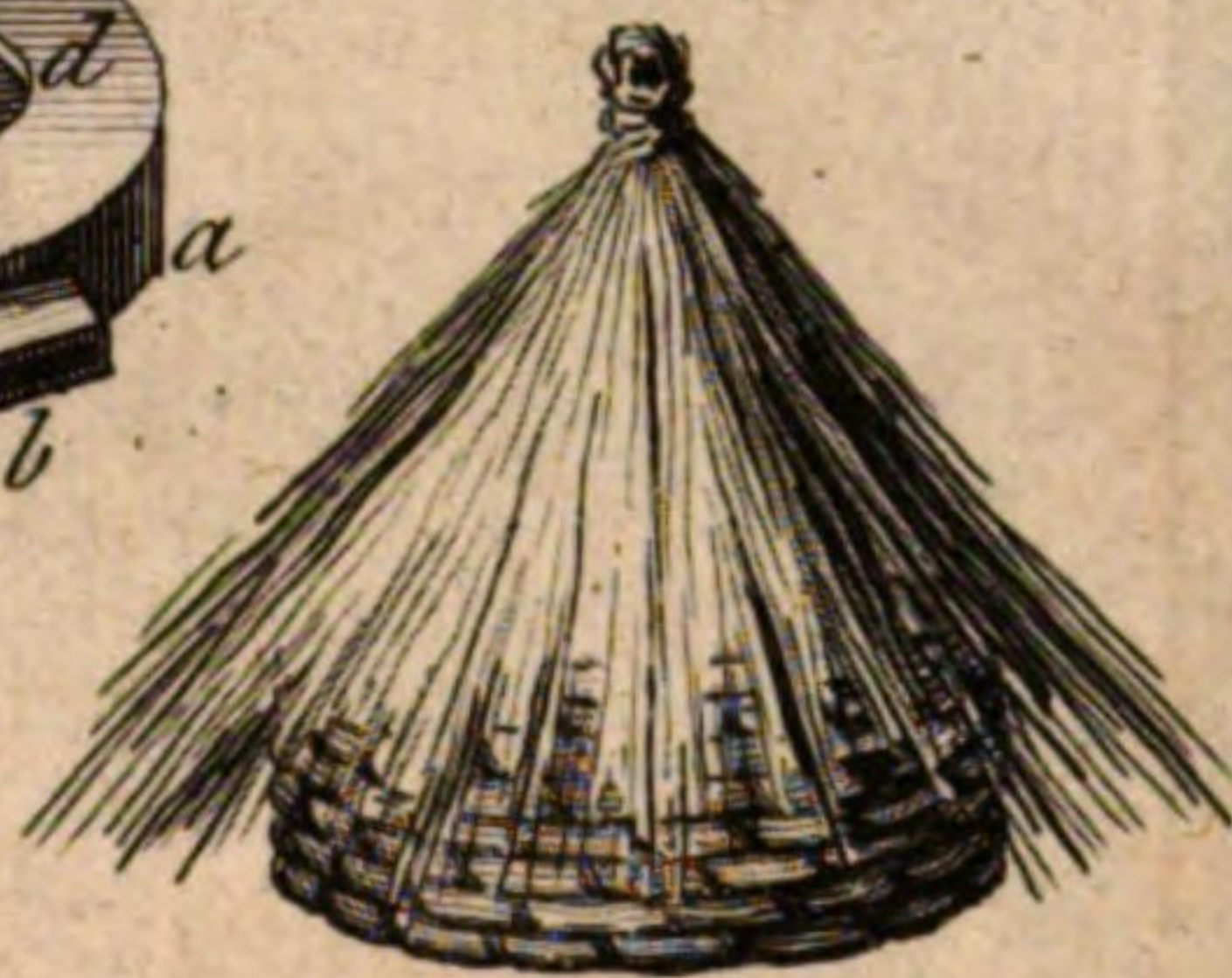


Fig. 1.

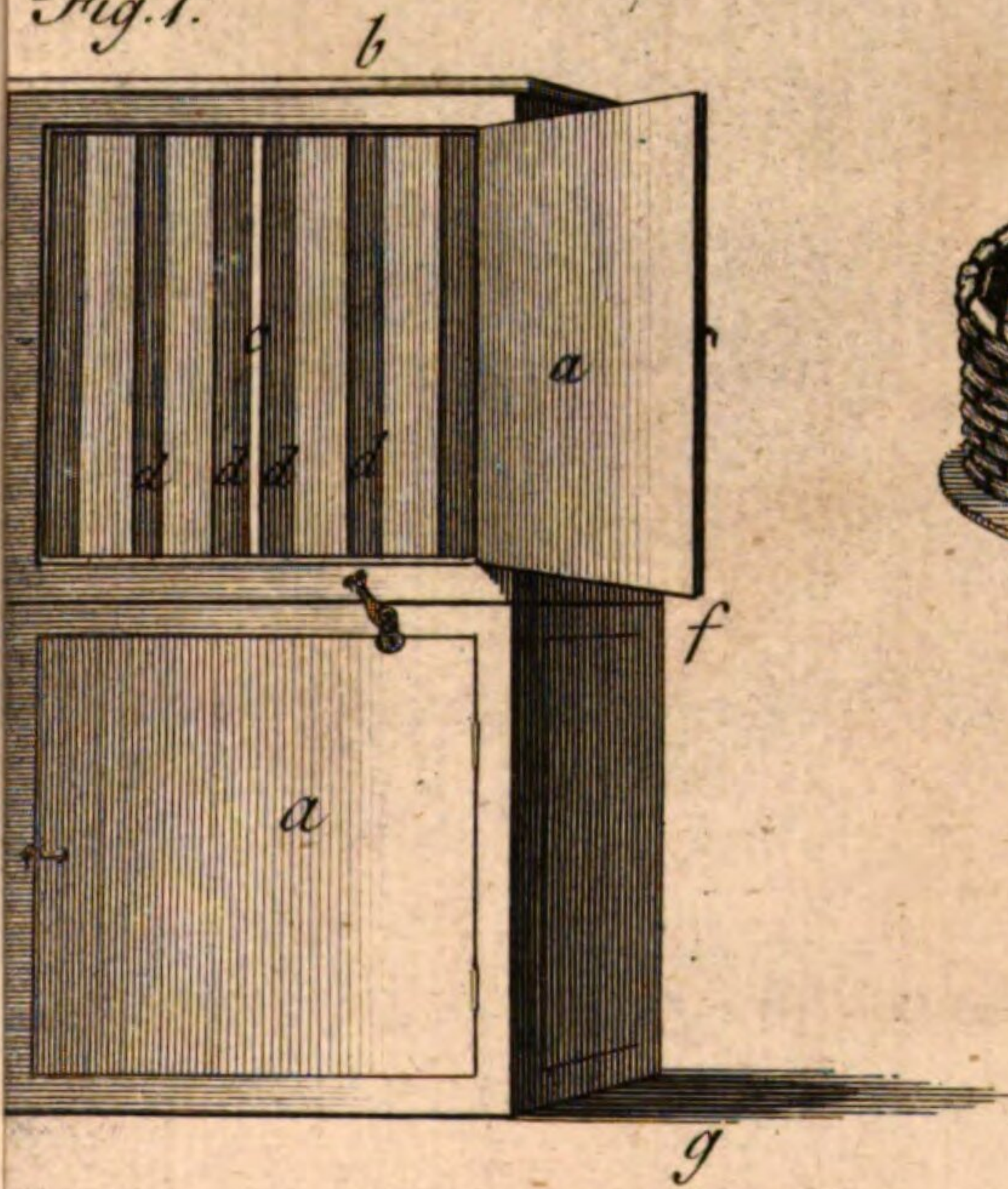


Fig. 5.



PLATE III.

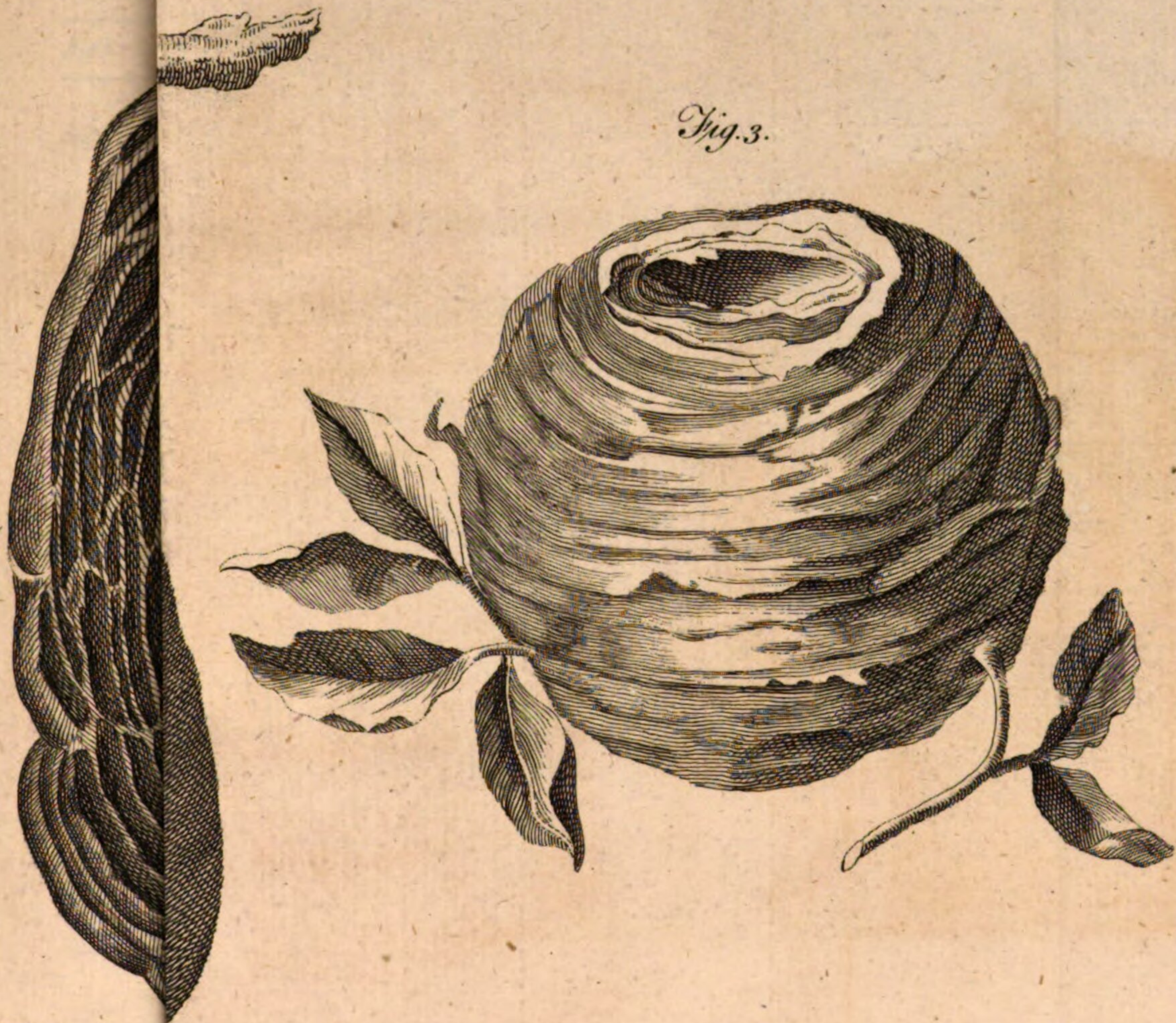
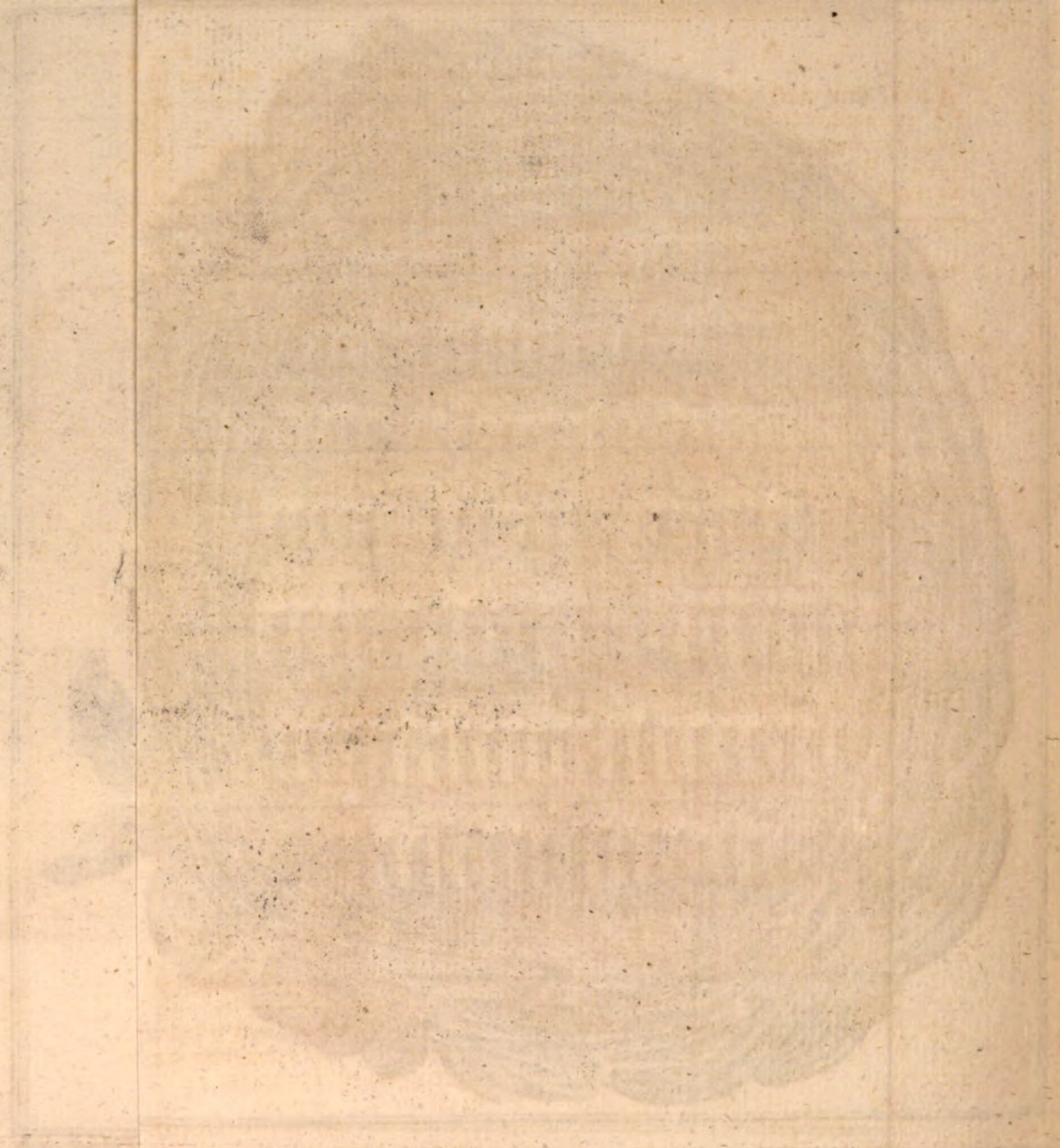


Fig. 3.

J. Mynde sculp.

I N D E X



I N D E X.

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Page	2.	line	5.	Instead of <i>Ceci</i> read <i>Cesle</i> .
	28.		5.	Instead of <i>we</i> read <i>rue</i> .
	34.		7.	Instead of <i>along</i> read <i>a long</i> .
	36.		20.	After the word <i>bottom</i> dele <i>of</i> .
	49.		5.	After the word <i>centre</i> dele <i>of</i> .
	54.		4.	Instead of <i>in</i> read <i>with</i> .
	58.		1.	Dele <i>the</i> .
	74.		13.	Instead of <i>has</i> read <i>does</i> .
Ditto.			24.	Instead of <i>on</i> read <i>of</i> .
155.			10.	Read Plate 3. Fig. 3.







Wildman, Thomas

A Treatise on the Management of Bees

London 1768

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